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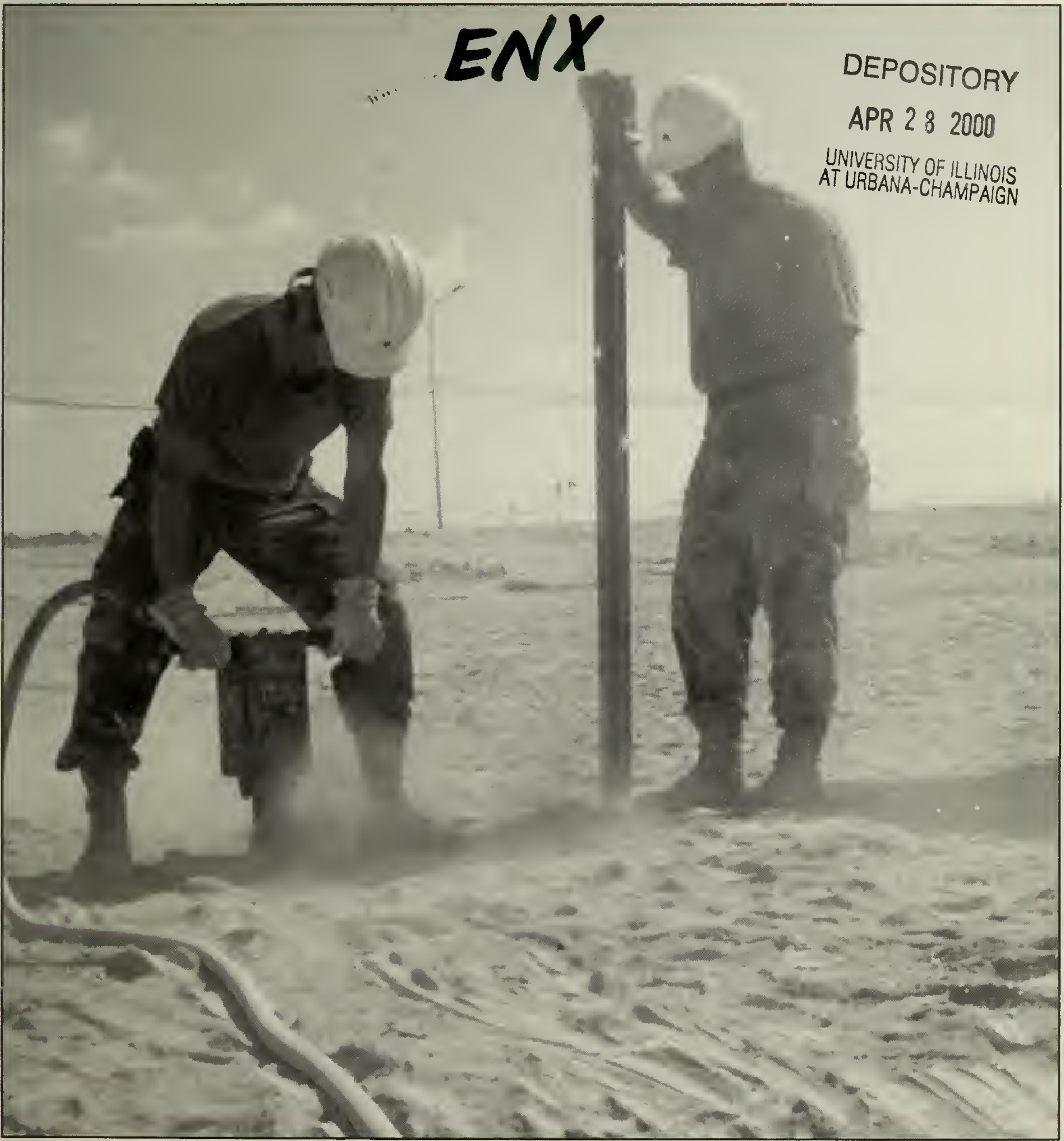

Exercise Bright Star

Headquarters, Department of the Army
PB 5-00-1 Approved for public release, distribution is unlimited.

CLEAR THE WAY

By Major General Robert B. Flowers
Commandant, U.S. Army Engineer School

I'm sure by now that most of you have read or heard about Chief of Staff of the Army (CSA) GEN Shinseki's desire to "***transform the World's Best Army into a Full Spectrum Force ... Strategically Responsive and Dominant.***" The first step of his transformation is the creation of two Brigade Combat Teams at Fort Lewis, Washington—a process that we want to achieve within the next 12-18 months.

These new highly mobile and lethal brigades are designed to be capable of deploying anywhere in the world within 96 hours. They will have about 3,500 personnel and will feature "off-the-shelf" technology that is more deployable and sustainable. All of the brigades' equipment will be air transportable by C-130 aircraft. The brigades are optimized for small-scale contingencies but will have the capability (when properly augmented) to perform stability and support operations and to participate in major theater war missions. They are designed to be combat capable upon arrival.

The brigades are infantry and information centric. Each will have three Motorized Infantry Battalions; a Reconnaissance, Surveillance, and Target Acquisition (RSTA) Squadron; an Antitank Company; a High-Mobility Artillery Rocket System (HIMARS) Battery; an Engineer Company (multifunctional and robust); and a Brigade Support Battalion. The infantry nature of the brigade provides superb strategic, operational, and tactical mobility to achieve decisive action through dismounted infantry assault. The RSTA Squadron will be equipped with a phenomenal array of data-collection equipment and will be responsible for providing the situational awareness necessary for the brigade to set the time and conditions for the fight. The brigades will be augmented with additional capability (armor, aviation, air defense, engineer, military police, chemical, etc.) based on a mission, enemy, terrain, troops, time available, and civilian consideration (METT-TC) analysis.

A unique aspect of the brigade is that it will be designed around a common medium armored vehicle (MAV) platform. The ultimate goal is to reduce the logistical and sustainment requirements. A common platform will translate to fewer spare parts, fewer maintainers, and a greatly reduced logistical footprint. The search for the optimal platform is ongoing. The Platform Performance Demonstration at Fort Knox ran more than 30 vehicles and their variants through a series of environments as we try to find the right balance between deployability, lethality, sustainability, and survivability. The Maneuver Support Center sent a team of officers and NCOs to Fort Knox to participate in the process to ensure that our engineer-unique needs are met.

We have designed a strong engineer capability to support the brigade's mobility requirements. The brigade headquarters includes a Maneuver Support Cell with a four-person Brigade Engineer Cell and Digital Topographic Support Cell. A senior engineer—a lieutenant colonel or major—heads the Engineer Cell to deal with the full range of expected missions and potential augmentation requirements such as USACE, contractor, host nation, and multinational assets. The Digital Topographic Support Cell, working in conjunction with the RSTA Squadron, will play a critical role in managing the brigade's topographic data in support of the intelligence preparation of the battlefield process and to ensure that the maneuver commander and his subordinate elements have a common topographic operating environment throughout the brigade's battlespace. The Engineer Company is designed to support the mobility requirements of the maneuver battalions. Its design includes three mobility platoons and a mobility support platoon. It is envisioned that this is a second command opportunity. The mobility platoons will feature an engineer variant of the MAV that will include mine-detection, breaching, rubble-clearing, and obstacle-creation capabilities. The mobility support platoon will be equipped with assault bridging and earthmoving equipment such as high-mobility engineer excavators (HMEEs) and deployable universal combat earthmovers (DEUCEs). The company will rely on augmentation from division and echelons-above-division engineer assets to provide additional mobility and the majority of the countermobility and survivability support required for the Brigade Combat Team.

Achieving the CSA's vision will require major paradigm shifts in the way we have traditionally done business in the Army and at the Engineer School. The successful transformation of these brigades will require unprecedented teamwork from every member of the regiment as we revolutionize our DTLOMS processes to meet the CSA's timelines. These will be intense, exciting times as we shape the future of the Army and the engineer's role in it. The Maneuver Support Battle Lab personnel are leading MANSCEN's efforts. They have reached out across the schoolhouse and the Army to bring in the right people with the right skills to help us create a capable and responsive engineer force for the Brigade Combat Team.

Our sleeves are rolled up and we are decisively engaged. Essayons!

Engineer

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Front Cover: *Soldiers from the 92d Engineer Battalion, 2d Platoon, Bravo Company, Fort Stewart, Georgia, use a jackhammer before laying security wire around 3d Army Headquarters, Mubarak Military City. They are participating in Exercise Bright Star 99/00 in Egypt. (U.S. Army photo by SPC Jamarco Bowen, 55th Signal Company.)*

Back Cover**:** *View of the initial Panama Canal construction, 19 May 1910, Culebra Cut, Culebra, showing small slide-obstructing steam shovel.*

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Engineer Support to Exercise Bright Star

By Lieutenant Colonel David Yanik

Planning support for an off-site exercise is always a challenge for engineers. Anticipating Class IV supply needs, melding participant requirements with resources, learning and understanding local conditions, setting priorities, and flowing proper troop skills and equipment to meet the phased needs of the plan are all considerations facing a commander and his staff. Additionally, any commander is challenged to integrate good mission-essential task list (METL) training into an operation without compromising the services the exercise director expects. These challenges are magnified when the exercise is held in the desert halfway across the world. Such was the task given to the 416th Engineer Command (ENCOM) and the 92d Engineer Battalion (Combat)(Heavy) in Bright Star 99/00.

Exercise Bright Star

United States Central Command (CENTCOM) conducted Bright Star 99/00 in Egypt during October and November 1999. It took place in the northern desert region of the country as a joint/combined/coalition, computer-aided command-post and field-training exercise. It was the most significant coalition military training exercise ever conducted by CENTCOM and the largest-scale deployment and employment exercise in the CENTCOM area of responsibility outside of the Arabian Gulf. More than 17,000 representatives from all U.S. service components, the Egyptian military, and nine other European and Gulf States partners participated.

As the subordinate engineer command of the U.S. Army Central Command (ARCENT)/Third U.S. Army, the 416th ENCOM was the command-and-control headquarters for four engineer units:

- The 92d Engineer Battalion (Combat)(Heavy), Fort Stewart, Georgia, was the lead unit for general support.
- The 1st Platoon, Company B, 249th Engineer Battalion (Prime Power), Fort Bragg, North Carolina, set up a 110-volt power gird to support U.S. standard equipment and minimize use of tactical generators.
- The 100th Engineer Company (Topographic), Fort Bragg, provided terrain analysis and bulk map sheet production.
- A detachment from the 306th Engineer Company (Separate)(Combat Heavy), a U.S. Army Reserve unit from Fort Totten, New York, deployed early on during the buildup to assist with interior wiring.

Planning for Bright Star 99/00 began during the previous exercise. At that time, representatives from ARCENT and the 416th ENCOM identified the need for permanent facilities for future exercises. The representatives developed a plan for a command-and-control complex to be funded under the Exercise-Related Construction (ERC) Program.

The Joint Chiefs of Staff approved the funding in 1999. The original proposal included a series of K-span buildings to be built by Reserve Component soldiers beginning in May 1999. When the evolving situation in the Balkans caused uncertainty as to funding for the project, a contracted design-construct project was coordinated with the Cairo Area Office of the Transatlantic Program Center, U.S. Army Corps of Engineers (TAC). The 416th ENCOM (Forward Cell) in conjunction with TAC-Cairo completed a complex of three pre-engineered (Butler-type) buildings. There were two 18,000-square-foot main exercise command-and-control buildings and a 4,000-square-foot Sensitive Compartmented Information Facility (SCIF).

416th Engineer Command Mission

The 416th ENCOM, with headquarters in Darien, Illinois, is a Reserve Component echelons-above-corps command-and-control headquarters that reports directly to the U.S. Army Reserve Command. A forward cell of 20 Active and Reserve Component soldiers, collocated with ARCENT at Fort McPherson, Georgia, directly supports the ENCOM's Middle East/CENTCOM area of responsibility planning mission. The forward cell was ENCOM's primary planner for exercise Bright Star 99/00.

The 416th ENCOM's primary objectives during this exercise were to—

- Provide engineering services to exercise participants through the command and control of assigned units.
- Provide technical and planning assistance, via a liaison officer, to the 377th Theater Support Command (TSC) in testing and validating its new role as overall theater logistics manager.
- Perform these duties while testing the structure and operating procedures of its early-entry module that deploys in support of ARCENT in case of a contingency.

The unit phased three rotations of soldiers into theater to man the command-and-control cell. Each rotation included regular Army officers and enlisted soldiers and reservists on 21-day (or longer) orders. The rotations reflected the Total Army concept that embodies the ENCOM itself. Each rotation with its mix of Active and Reserve Component soldiers blended the experience of active soldiers with the technical skills of part-time unit members. Rotations were structured around anticipated missions and the skills required at important junctures of the exercise, while taking into consideration the transportation constraints of a deployment halfway across the world.

At the exercise site, the ENCOM staff focused on what an engineer headquarters does best: identifying engineer requirements, assigning work, monitoring the progress, performing quality control, and solving problems. Its main tasks were to provide assistance to the engineer units in the reception, staging, onward movement, and integration of personnel and equipment; coordinate and prioritize construction effort during the buildup and sustainment stages; and coordinate the orderly closeout of engineer activities and the installation before redeployment. The cell of three officers and two or three NCOs was constantly in the field inspecting progress, coordinating support, and preparing for the next phase of infrastructure development. The austere communications capabilities, especially during the startup and base-development stages, made direct contact with units necessary to meet the changing conditions and to rapidly complete projects for arriving soldiers.

To track and control the operation, a master list of requirements and projects was developed before departing from CONUS. This list was the baseline for all activities. At the exercise site, the ENCOM became the single point of contact for all new support requests. Units and deploying headquarters, including other services and coalition partners, were instructed to submit work and support requests through the ENCOM cell. The liaison officer stationed with the 377th TSC became the point of contact for most TSC requests, which were tracked through an Access database. At daily status meetings attended by representatives from subordinate engineer units and the supported headquarters, priorities were assigned, progress tracked, and work integrated into each unit's schedule. This meeting gave staffs an opportunity to raise issues, disseminate important information, and put out fires. Additionally, each unit submitted daily situation reports, which were consolidated and forwarded appropriately. The ENCOM now had a valuable electronic record of Bright Star 99/00 activities.

An added benefit of the exercise was recording and evaluating some of the field-expedient structures fabricated and used by participating units. Valuable data was gathered on

Soldiers from the 249th Engineer Battalion, Fort Bragg, work continously to keep the lights running during Bright Star 99/00.

Typical view of the interior partitions and finish of the exercise control building used by the major participants of Bright Star 99/00. Panels and electrical wire were completed by the 92d Engineer Battalion (C)(H).

desert theater-of-operation structures that were constructed under conditions that might apply in other situations. (The 416th ENCOM, in conjunction with the Engineer School at Fort Leonard Wood and the Huntsville Division of the Corps of Engineers, continuously upgrades its database of theater-specific structures in the Theater Construction Management System program.)

92d Engineer Battalion Mission

The battalion received notice to participate in Bright Star 99/00 in February 1999. During a series of planning meetings and site surveys, it became apparent that Bright Star would provide an excellent opportunity to train and evaluate most of the battalion's METL tasks. Unlike typical exercises that almost exclusively emphasize horizontal or vertical skills, this deployment provided a good balance of carpentry, electrical, and interior finish work along with ample dozer/blade, line haul, and other horizontal tasks.

Having time to train was important to the battalion commander. The 92d was OPCON to the 416th ENCOM, but when the ENCOM's base-development mission could not keep the entire unit occupied, the battalion staff was ready with plans to meet its own training and readiness objectives. The staff took advantage of every available training opportunity. Although significant effort was required during the initial setup stages of the exercise, once the exercise platform was in place, there were many opportunities for unit-directed training. This included honing both special staff skills and combat engineer skills through the support of the 3d Infantry Division's field-training-exercise operations.

By the time the exercise was completed, the battalion had built more than 25 miles of force-protection berm, reconstructed an old ammunition supply point (ASP), and developed a new open-storage ASP for coalition forces. It cleaned up and made functional the water system for the tracked-vehicle wash rack, assembled more than 210 wooden field latrines that had been prefabricated at home station, and wired and partitioned more than 40,000 square feet of exercise area. It constructed countless guard shacks, guard towers, tables, tent floors, and shelves; spread more than 4,000 cubic meters of gravel in parking lots and other vehicle storage areas; and dug more than 35 tracked-vehicle positions for the 3d Infantry Division.

The 92d operated an efficient Class IV yard and, when the exercise was over, the battalion collected, inventoried, and warehoused the majority of these items for future use. The projects required 191,000 square feet of plywood, a ton of nails, and 71 miles of interior wire. The tasks were accomplished with no major accidents or injuries and an equipment availability rate well above 80 percent.

249th Engineer Battalion Mission

1st Platoon, Company B, 249th Engineer Battalion (Prime Power), is stationed at Fort Bragg, while the battalion is headquartered at Fort Belvoir, Virginia. The platoon was involved in the exercise planning from the beginning. Using site surveys and after-action reviews from past exercises, 249th personnel decided to deploy four 750-kilowatt generators to support the main camp grid and two 500-kilowatt generators as a dedicated power source for lights and air conditioning for the main exercise buildings and the Sensitive Compartmented Information Facility. This translates into a capability of producing enough electricity to support a town of 10,000 people.

A team of one warrant officer and 10 sergeants designed the grids, laid cable, located transformers and breaker boxes, and prepared the plants for operations. The team installed more than 44,000 feet of high-voltage cable and 14 transformers, which provided power from three generators serving more than 2,000 customers. The 249th provided uninterrupted power for 45 days with no equipment-induced electrical outages to the 110/208 grid while pulling all scheduled services. There were no work-related injuries.

The prime power battalion is the only one of its type. Assigned directly to the U.S. Army Corps of Engineers, it is generally deployed to support disaster relief or in an advisory role to operations in locations such as the Balkans. There, the unit's technical expertise is used to maintain host-nation assets. Exercises of the magnitude and scope of Bright Star are rare and pose unique challenges for soldiers of the 249th. For example, the soldiers are seldom asked to incorporate different configurations of distribution systems as they were during Bright Star 99/00. And seldom do they have an opportunity to perform and train on so many individual and collective skills. By the deployment's end, the squad had trained and validated 95 percent of its METL squad.

100th Engineer Company Mission

Part of the 30th Engineer Battalion (Topo), Fort Bragg, the 100th Engineer Company (Topo) was the only engineer unit assigned to the 416th ENCOM that was not associated with the facilities support mission. A combat topographic company, the 100th deployed to Bright Star 99/00 with a seven-person terrain-analysis squad and its heavy print-plant squad.

Assigned to the ENCOM for administrative and logistics support, the 100th was directly tasked by the ARCENT G2. The terrain-analysis team set up operations near its customers within the ARCENT headquarters. Using digital data and satellite imagery supplied by the National Imagery and Mapping Agency (NIMA), the team built and reproduced numerous map products and other tactical decision-making aides. Major projects completed during the exercise were maps showing the training areas and ranges, a special two-map set of navigational aids for the aviation units, special obstacle maps for the exercise, and 14 other special maps. This effort translated into 1,400 man-hours of work that produced maps consuming more than 1,300 linear feet of map paper.

The heavy print-plant section included seven soldiers and a field bulk-production plant consisting of three vans and an associated support trailer. The crew, which received assignments through the ARCENT G2, completed bulk runs of special maps produced for a specific phase of the exercise and stock maps from the NIMA inventory. In 105 operational hours, the print plant produced 9,000 map sheets and distributed more than 5,000 of them to soldiers in the field. The project allowed evaluation of all of the team's major METL tasks.

Bright Star 99/00 was an excellent training vehicle for the terrain-analysis team. Being a very specialized organization, the skills are hard to train and often overlooked at home station. This deployment allowed team leaders to instruct, evaluate, and reinforce the skills needed by their soldiers. For the new and inexperienced unit members, this was especially valuable because it was the first opportunity to apply perishable 81-series military occupational specialty skills learned at advanced individual training.

The efforts of these two squads proved that even in this age of digital technology, organizations like the 100th are still required. During deployments, soldiers on the battlefield will always need paper map products, because nothing beats their detail and resolution. And nothing beats the capability of field topographic units to provide the broadest dissemination of terrain intelligence.

Lessons Learned

Exercises are great opportunities to learn and train. They require much of the same detailed planning effort as tactical deployments but are executed at a pace more conducive to training, learning, experimentation, and trial and error. The engineer organizations participating in Bright Star 99/00 came away with a better understanding of their strengths and weakness, the status of their METL proficiency, and the direction needed for improvement.

In austere environments like Egypt, if you don't plan for it before deployment, you may have to do without it. In the Third World, westerners cannot count on having access to supplies and services in the quantities an exercise like Bright Star may require. Predeployment site surveys and planning conferences help ensure that critical items of support are available to meet mission demands.

Engineers must be given sufficient priority for available air- and sealift at the beginning of the exercise. Having engineer units on the ground as early as possible with the right equipment and soldier skills ensures that satisfactory infrastructure is in place before the main body of the exercise arrives.

Engineers must lead the way in anticipating, identifying, and planning support to other exercise participants. Many units were unable to adequately identify their support requirements or were very late in submitting these requests. Developing a database of common support tasks at the Army and ENCOM levels saves countless hours of coordination and planning and provides better preparation for future exercises with similar force mixes.

Conclusion

Participation in Bright Star 99/00 was a success for all engineers involved. The exercise mission, force structure, and austere desert conditions provided an excellent environment for all levels of command to train, test, and evaluate unit readiness. Across the board, engineer participants were satisfied that their time was well spent and that the experiences and lessons taken from the exercise will be drawn upon for years to come.

Lieutenant Colonel Yanik is an Active Guard Reserve officer serving as a senior team leader, 416th ENCOM Forward Cell, Fort McPherson, Georgia. Previous assignments include service with Third U.S. Army; FORSCOM; the U.S. Army Reserve Command; 412th ENCOM Forward, Heidelberg, Germany; 104th Division (IT); 70th Regional Support Command; and CJTF-Kuwait. LTC Yanik holds a bachelor of science degree in civil engineering from Lafayette College, Easton, Pennsylvania, and is a graduate of the Engineer Officer Advanced Course and Command and General Staff College.

Engineers Keep the Peace in Kosovo

By First Lieutenant Paul C. Stephenson

In July 1999, the Assault and Obstacle Platoon, Bravo Company, 9th Engineer Battalion (Combat), transitioned from traditional engineer missions to peacekeeping operations in the city of Gnjilane, the capital of Eastern Kosovo. The platoon initially occupied a schoolhouse but later moved to the main post office and medical clinic in downtown Gnjilane (see Figure 1). The mission was to provide security and stability to the city's northern sector according to the Military Technical Agreement (MTA). Signed in June 1999 by both Serbian and Kosovar Albanian leaders, the MTA outlined the withdrawal of Serbian forces from Kosovo and the demilitarization of the Kosovo Liberation Army (KLA). The platoon's duties in Gnjilane included dismounted patrols, checkpoint operations, and building searches. The platoon also ensured free access for both Kosovar Albanians and Kosovar Serbs at the clinic and post office. This article describes how the platoon conducted its operations and discusses lessons the platoon learned during its stay in Gnjilane.

Gnjilane

The largest city in Eastern Kosovo, Gnjilane serves as the cultural and economic center of the region. The prewar estimated population of the city was about 50,000. The ethnic breakdown among the population before the war was about 71 percent Kosovar Albanians and 23 percent Kosovar Serbs. In addition, Gnjilane was home to small Gypsy, Turkish, Montenegrin, and Croatian communities that accounted for 6 percent of the population. The majority of the factories and businesses in Gnjilane catered to the region's agricultural industry.

The Threat

In June 1999, marines from the 26th Marine Expeditionary Unit occupied Gnjilane. During the first few weeks, daily shootings between Kosovar Serbs and Albanians resulted in several casualties. On a few occasions, marines were caught in the crossfire. In addition, house fires set by arsonists occurred on a daily basis.

By the time Bravo Company, 9th Engineer Battalion, relieved the 26th in northern Gnjilane, much of the shootings and fires had subsided. However, the most serious threat to the Assault and Obstacle Platoon was still the possibility of being caught in the middle of aggressive actions between Kosovar Albanians and Kosovar Serbs, who continued to attack each other in direct violation of the MTA. These groups—which included current and former KLA members, KLA sympathizers, organized crime figures, disgruntled Kosovar Serbs, and former Serbian paramilitary—were involved in shootings, arson, home invasions, bombings, and kidnappings. In addition, local Kosovar Albanians committed similar crimes, such as lootings and house burnings, against Gnjilane's Gypsy population in an attempt to force them from their homes. Local

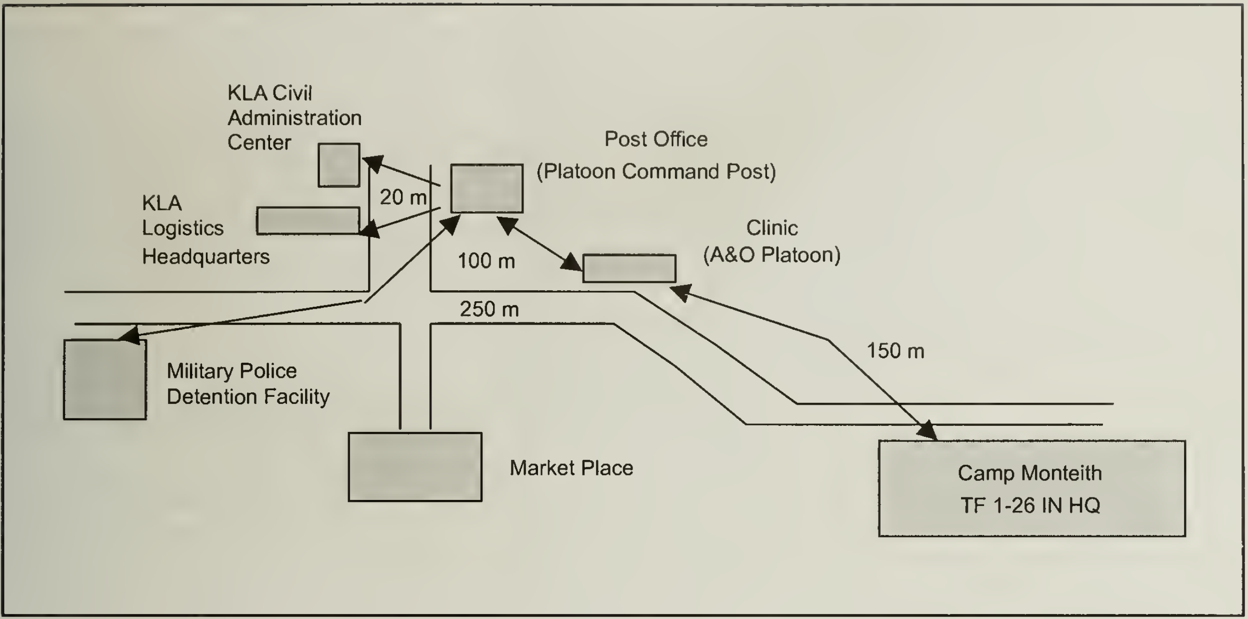

KLA Civil Administration Center
Post Office (Platoon Command Post)
20 m
KLA Logistics Headquarters
Clinic (A&O Platoon)
100 m
250 m
150 m
Military Police Detention Facility
Market Place
Camp Monteith TF 1-26 IN HQ

Figure 1. Downtown Gnjilane

Albanians distrusted Gypsies, who were allegedly members of Serbian paramilitary groups and police during the war.

Daily Operations

To minimize the threat against the platoon and to provide stability to the area, we conducted presence operations throughout our sector of Gnjilane. These operations included dismounted patrols, checkpoint operations, and building searches.

Dismounted Patrols

Dismounted patrols consisted of four to seven soldiers. The patrol schedule varied to cover periods of time when house fires and lootings occurred most frequently, which was during the late afternoon and early evening. Manning requirements increased for night patrols to provide more security.

Many soldiers in the platoon had not conducted patrolling operations since basic training, so the patrols provided a good training opportunity. In addition, the platoon could interact with the population, which was the highlight of the deployment for some soldiers. On patrol they could see the results of the operations—people coming back to their homes, children playing in the streets, and the beginning of the slow rebuilding process.

Checkpoint Operations

Nightly checkpoint operations were conducted at the squad level to enforce curfew. Locations varied among different intersections throughout the sector to avoid developing a pattern. At checkpoints, pedestrians and vehicles were stopped and searched thoroughly. Manning for checkpoints varied from four to eight soldiers with one NCOIC. Search teams consisted of one or two soldiers to provide security and two-man search teams. Each vehicle or individual without a curfew pass was systematically searched.

Building Searches

The most complicated operation the platoon conducted was building searches. Several factors were taken into consideration to make the searches a success:

- To justify our entry into buildings, probable cause must be established.
- To determine entry/exit routes and security needs, a thorough reconnaissance of the buildings was required.
- Based on information collected during the reconnaissance, a search plan was created and briefed. The plan included the security team and building-search team breakdown, searching methods, and where the entry would take place.

Across the street from our command post at the post office were two unauthorized KLA buildings—a logistics headquarters and a civil administration center. The platoon was to search these buildings for illegal activity. Several days before the search, the platoon conducted detailed surveillance of the buildings. Sketches were made of the buildings, and persons entering and exiting were tracked to determine when the building was least occupied. During the surveillance, several uniformed KLA members regularly entered and exited the buildings. In addition, we noticed antennas on the roofs and communications wire between the two buildings. Both the uniformed KLA members and the communications equipment were indications that KLA command-and-control activity may have been occurring inside. The platoon's surveillance of the buildings also included a thorough reconnaissance on each side of the buildings by two three-man teams.

After the reconnaissance, search teams were formed to execute the mission. The platoon was divided into security elements, search elements, and a command-and-control element. The search elements acted as assault elements while security elements acted as support. Security elements, which consisted of two-man teams, were placed along likely escape routes. Security teams were to detain anyone who left the building. A roving search team in the street would provide fire support if required. Search teams were divided into two-man personnel-search teams and two-man room-search teams. Although FM 90-10-1, *An Infantryman's Guide to Combat in Built-Up Areas*, recommends three-man room-search teams, our teams were reduced by one person to increase the number of teams. The command-and-control element consisted of the platoon leader, a radio-telephone operator, and a translator.

The KLA logistics headquarters was the first building the platoon searched (see Figure 2). With security in position, the search teams and the command-and-control element approached the building. When the command-and-control personnel reached the building, they were met by a security guard. Through the translator, they explained to the guard the nature of their search and determined if there was anyone else in the building. Then they took the guard to a personnel holding area to be searched.

Meanwhile, the room-search teams entered the building and began to search each room methodically from the first floor to the attic. They checked for KLA documentation in desks, filing cabinets, closets, and safes. When they found documentation, they took it to be translated. Any document that mentioned illegal KLA activity was turned over to the command-and-control element. The search teams also searched sheds in the rear courtyard for military equipment, ammunition, and weapons. The security guard was brought back into the building to open doors and answer questions.

The search of the logistics headquarters confirmed our initial suspicions. Although no weapons or ammunition were found, illegal activity was occurring in the building. Besides conducting unauthorized logistical activity, information found on a computer in the building revealed possible KLA criminal activity in the Gnjilane area. After informing higher headquarters of the results of our initial search, a debriefing team from the task-force intelligence section documented and collected our findings. While the intelligence section continued the search, the platoon remained on-site to secure the building. The debriefing team confiscated several documents as well as the computer. The KLA logistics director, who arrived after the search began, and the security guard were detained and transported to the military police detention facility.

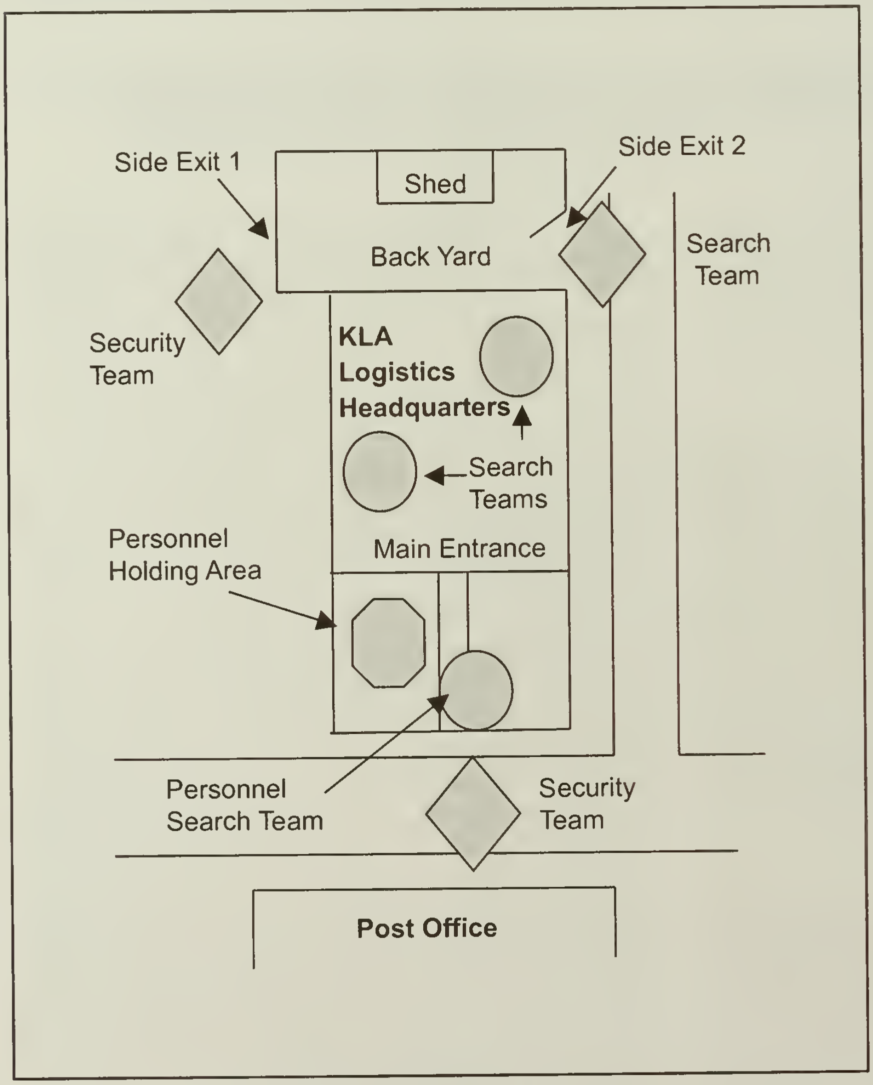


Figure 2. Building Search

Lessons Learned

The platoon learned the following lessons during these operations:

Security, Security, Security

All of our operations occurred in heavily populated areas. While the threat level was low after the first few weeks, there was always the possibility of an attack. To protect against possible threats, a security man or team overwatched during all operations. Whether stopping cars at checkpoints or searching buildings, security remained the top priority.

Command and Control

FM 90-10-1 states that in military operations in urban terrain (MOUT), small-unit leaders must have the initiative, skill, and courage to accomplish missions while isolated from their units. During our patrols and checkpoint operations, squad leaders—and in some cases junior NCOs—were the senior leaders on the ground. To ensure that patrols and checkpoint operations were conducted to standard, a thorough mission brief and precombat inspections and checks were essential. We ensured that there was time set aside to go over every aspect of the patrol and to conduct back briefs and rehearsals. Before every patrol, leaders briefed their squads on mission objectives, contingency plans, etc.

Essential Equipment

The table below lists equipment that was useful during operations in Gnjilane. Premade plastic handcuffs called flex cuffs, which are easy to handle and reusable, were invaluable during building searches and checkpoint operations. All soldiers had to do was place a detainee's hands in the cuffs and ratchet the straps down. A release mechanism in the cuffs allowed them to be reused.

Night-vision-goggle (NVG) helmet mounts also were useful during night patrols. The mounts freed soldiers' hands, allowing them to maintain better control of their weapons. Instead of having to raise and lower NVGs hanging around their necks, soldiers flipped their NVGs down from their helmets for quick use.

Logistics Building

One piece of equipment the platoon wished for was AN/PRC-127 radios, because they needed radios with good range and the ability to recharge for internal communications. The German-made handheld radios we used had poor range and required eight AA batteries that lasted from 24 to 48 hours. AN/PRC-127s would have been a reliable secondary means of communication in case our portable Single-Channel Ground-to-Air Radio System (SINCGARS) manpacks malfunctioned.

Systematic Approach to Searches

Before a search, discuss how it will be conducted and then rehearse to improve efficiency. For example, discuss which end of a vehicle or which floor of a building will be searched first. With personnel searches, practice search techniques so no part of the person is left unsearched. Finally, use the same soldiers to conduct searches to improve efficiency. Once teams

Mission-Essential Equipment

Item Name	National Stock Number
NVG Helmet Mount	5855-01-421-7691 5855-01-441-0401
Ranger Vest	8470-00-V22-1301 8470-00-V22-1302
Flex Cuffs	Local Purchase
AN/PRC-127	5820-01-438-7852 (Receiver) 6140-01-438-7852 (Rechargeable Battery) 6130-01-274-0839 (Battery Charger) 5905-01-274-5016 (Hand Mike)
Camel Back	8465-01-396-9917
Large Flashlight	Local Purchase
Chem Light	6260-01-195-9753 (Orange) 6260-01-074-4229 (Green) 6260-01-074-4230 (Yellow) 6260-01-178-5559 (Red) 6260-01-178-5360 (Blue)
Digital Camera	Local Purchase

The Engineer Writer's Guide

We think engineers take a special pride in their profession, and *Engineer* is always looking for articles from readers who want to share their expertise, experience, and ideas.

If you are a potential contributing writer, here are a few "writer's guide" tips to steer you in the right direction.

Articles may discuss engineer training, operations, doctrine, equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers, that's what we need.

Articles should generally come from contributors with firsthand experience of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words, and text should be double-spaced. Generally, each such page should contain from 200 to 250 words. Manuscripts should be originals or clear copies. Provide a 3 1/2-inch disk in Microsoft Word, Rich Text Format, or ASCII (please indicate word-processing format on disk or cover letter). You also may send articles by e-mail to *bridgess@wood.army.mil.*

Articles containing attributable information or quotations not referenced in the story should carry appropriate endnotes.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint.

Include your full name, rank, current unit, and job title. Also include a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime phone number.

Reviews of books on engineer topics are also welcome.

Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 Engineer Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges or Lynne Sparks, at DSN 676-4104, or commercial (573) 563-4104. We look forward to hearing from you.

Note: Due to the limited space per issue, we will not print articles that have been accepted for publication by other Army professional bulletins.

are trained, rotate other soldiers to gain experience. During the first week in Gnjilane, we learned that the situation on the street can be very fluid. Using systematic approaches and practices allows soldiers to concentrate on a search while remaining aware of the changing situation around them.

Winning With Civilians

Develop a positive relationship with local civilians during the initial occupation phase. When we arrived at the post office and clinic, we established a strong presence in the neighborhoods. The intent was to let the people know we were there to provide stability and security to the area. To accomplish this, we held meetings with local leaders and the people. As a result, they became our eyes and ears and often came to us to report fires and suspected lootings.

Maps

The normal scale of 1:25,000 and 1:50,000 on military maps will not suffice in a MOUT environment. Military maps of Gnjilane only showed the main routes, so the platoon used "tourist maps" of the city. The large-scale maps, which were obtained through the help of civil affairs, showed every street in our sector. Since patrols were unable to give grid locations using the city maps, the squad took a plugger along in case a grid was required on their location.

Conclusion

As the platoon became more proficient with peacekeeping operations, we began to fine-tune our techniques. Conducting presence operations gave NCOs and soldiers an opportunity to learn and practice search techniques on personnel, vehicles, and buildings. In the process, squad leaders and junior leaders learned valuable lessons that they will carry with them throughout their careers.

First Lieutenant Stephenson is the Assault and Obstacle Platoon leader for Bravo Company, 9th Engineer Battalion (CBT), in Schweinfurt, Germany. Previous assignments include combat engineer line platoon leader and task-force engineer for Task Force 1-18 Infantry, Camp Able Sentry, Macedonia. 1LT Stephenson holds a degree in environmental policy analysis and planning from the University of California, Davis.

U.S. Army Firefighters

By Sergeant First Class Leroy A. Ward

U.S. Army firefighters make up only a small section of the Corps of Engineers. About 242 active duty military firefighters and 573 in the Reserve Components represent both table of organization and equipment (TOE) and table of distribution and allowance (TDA) assignments.

In today's Army, there are seven active duty TOE fire-fighting detachments, consisting of two to six soldiers, and 25 Army Reserve and National Guard TOE fire-fighting units, consisting of six to 30 soldiers. Many soldiers and leaders are unaware of the existence of these detachments and the services they provide. This article gives a brief overview of the organization, training, and role of Army military occupational specialty (MOS) 51M firefighters and fire-fighting units.

Missions

Army firefighters provide fire-fighting services, including fire protection and fire prevention, to theaters of operation. During deployments, firefighters are task organized—usually as general support (GS)—to the joint task force, who in turn makes them GS to the supported unit. Although they are GS due to their uniqueness, these fire-fighting teams require mess, maintenance, logistical, and administrative assistance from the supported unit. Firefighters have three primary missions:

Aircraft Crash/Rescue Fire Fighting

This is firefighters' most demanding mission and involves aircraft or ground vehicles that are burning or have crashed. Firefighters must be familiar with basic safety procedures of all U.S. aircraft. Although the emphasis is geared toward rotary-wing aviation assets, firefighters must also be familiar with fixed-wing aircraft.

Structural Fire Fighting

This mission encompasses burning of static objects, such as tents, houses, barns, and other buildings. Fire-fighting teams require skilled technical training so they can quickly execute fire-fighting "battle drills." These include connecting fire trucks to hydrants, venting buildings, and searching for victims in smoke-filled buildings.

Fire Prevention

This task includes taking active and passive measures to prevent fires from occurring. Active measures, which include building inspections, generally are left to sergeants and above. Passive measures are encouraged by all firefighters through public relations and safety programs.

Responsibilities

Firefighters support two general types of units or customers. The first is U.S. Army or Air Force aviation assets. Most aircraft use a more flammable fuel than ground vehicles and require additional attention during fueling and defueling operations. Attack aircraft are twice as dangerous, since onboard fuel has the capability of detonating ordnance on the aircraft.

The second type of customer is units that live in a large collection of tents or base camps. The tendency to erect tents close together and the propensity of canvas and wood to burn creates a risk to occupying soldiers. Army firefighters work with unit or installation safety offices to provide and enforce fire-prevention guidelines for these temporary shelters.

Army firefighters are not limited to these customers during combat operations. Other tasks may include providing aid to host-nation fire departments and protecting

U.S. Army firefighters enter a smoke-filled building.

ammunition storage points; petroleum, oil and lubricant (packaged and bulk) storage points; motor pools; and internment/dislocated-civilian camps.

Types of Units

Army firefighters are organized into two types of detachments: headquarters (LA) and fire-fighting (LB). These detachments may be task organized based on the size of the area to be covered, the number of vehicles or aircraft that require protection, and the availability of other military firefighters (Air Force or Navy).

LA Detachment

This detachment serves as the command-and-control function for three to five other detachments. The four-soldier team consists of an MOS 21B fire marshall (a first lieutenant), an MOS 51M40 fire chief (a sergeant first class), an MOS 51M30 fire inspector (a staff sergeant), and an MOS 63B10 mechanic. Equipment for the LA detachment includes two HMMWVs and assorted radios for establishing a base station. Missions are to—

- Plan fire-fighting programs and area fire protection.
- Exercise command and control during rescue and fire-fighting operations.
- Conduct fire-prevention operations, to include determining building classification and conducting installation-level inspections.
- Develop plans for handling hazardous-material emergencies.
- Conduct initial fire-ground investigations.
- Conduct fire department unit maintenance operations for technical fire-fighting equipment not provided during deployment from local support maintenance activities.

Firefighters extinquish a burning fuel spill.

Firefighters inspect their self-contained breathing apparatus gear.

LB Detachment

The core of the fire-fighting team, these detachments consist of an MOS 51M30 team chief (a staff sergeant), an MOS 51M20 crash rescue sergeant, two MOS 51M10 crash rescue specialists, and three MOS 51M10 driver/operators. LB detachments operate the fire-fighting equipment, which includes a fire truck, a water truck, self-contained breathing apparatus, a hydraulic jaws set, and crash kits. They provide 24-hour fire protection and personnel rescue support, administer timely and adequate first aid, and implement a fire prevention program(s) for—

- Life-support areas.
- Intermediate staging bases.
- Forward-operating bases.
- Petroleum, oil, and lubricant tank farms and distribution sites; open and closed warehouse facilities; or general depots.
- Enemy prisoner of war and civilian internment camps.

MOS Training

Army firefighters begin their military careers with basic training at Fort Leonard Wood, Missouri. When they graduate, they are transferred to Louis F. Garland Fire Academy, Goodfellow Air Force Base, Texas, which is the home of fire-protection training for the entire Department of Defense. Here, firefighters attend advanced individual training (AIT) for the 51M MOS. Operated by the Air Force, this joint service school has 125 multiservice and civilian instructors. Training provided by the academy complies with the National Fire Protection Association (NFPA) standards. Soldiers, airmen, marines, and sailors train together for 13 weeks on individual and crew drills. Trainees must maintain the TRADOC academic standard of 70 percent but also must pass several physically demanding tasks, as well as standardized written and performance evaluations, to graduate. After completing AIT, soldiers are NFPA certified at the *Firefighter II, Airport Firefighter*, and *Hazardous Materials* operational levels.

Career progression for firefighters is unique. They are trained and nationally certified as firefighters in MOS 51M through the grade of E7. When they are promoted to master sergeant/E8, they leave this MOS and change to MOS 51Z general engineering supervisor, where they are involved with other engineer specialties not normally associated with fire fighting.

Certifications

Department of Defense manual 6055.6-M, *Fire and Emergency Services Certification Program*, is a component of a national certification system for firefighters and others in the fire-protection career field (fire fighting and rescue, fire-department management, training, inspections, etc.). The Firefighter Certification System is accredited by the International Fire Service Accreditation Congress (IFSAC). The certification program is mandatory for all Department of Defense firefighters—military, civilian, and contractors. Certification requirements are governed by the applicable NFPA standards. These standards prescribe precisely what must be done for certification at each level.

Certification may be obtained by completing correspondence courses (called career-development courses) combined with performance tests, resident training schools (such as state and local fire academies and the Louis F. Garland Fire Academy) accredited by IFSAC or the National Professional Qualifications Board, and other training that is *proven* to be equivalent to that required by the NFPA. The Air Force Civil Engineer Support Agency, Contingency Support Directorate, Tyndall Air Force Base, Florida, manages and administers this program.

Military firefighters depend on federal and state training facilities to provide instruction on various skills. The two major training resources to test fire-fighting skills are a *smokehouse* and a *burn pit*. A smokehouse is a building vented with ducts to produce a blanket of smoke within the building. Soldiers are required to enter the building and rescue any personnel found inside. A burn pit is a concrete bowl with a special drain system in which objects can be set afire. Firefighters use a combination of water and foam to extinguish burning vehicles and aircraft. The special drain system in the bottom of the pit separates the water and foam so each can be recycled. Performing these two training events is equivalent to a combat arms unit live-fire exercise.

Army fire-fighting units maximize the use of these training facilities for their soldiers, who rarely attend specialty training such as Airborne or Air Assault School. Some colleges offer an associate degree in fire science, which is an excellent resource for building a competent fire-fighting unit. Although this training is expensive, soldiers benefit from being trained by subject-matter experts and receiving hands-on training with live-fire burnings.

Wearing protective gear, firefighters inspect a burned-out helicopter.

Summary

Soldiers and leaders face several challenges concerning firefighters in TO&E units. Leaders must balance military requirements and fire-fighting certification requirements. It is difficult to schedule qualification ranges or mandatory classes while soldiers are working day-on/day-off rotations. Career soldiers must maintain all required engineering skills. Staff sergeants must work hard to retain their engineer-specific skills, such as construction and bridging, to complete the Basic and Advanced Noncommissioned Officer Courses.

The presence of military fire-fighting detachments in theaters of operation is not commonly known or understood, but firefighters play a critical role there. In addition to their primary missions, firefighters provide benefits to all soldiers, since they also receive lifesaving training. Commanders must take active steps to include these detachments in their companies and battalions and help make the theater safer for all personnel.

Sergeant First Class Ward is a senior firefighter observer-controller/trainer with the Engineer Training Support Battalion, Fort Lewis, Washington. Previous assignments include the 89th Engineer Detachment (FF) Fort Bragg, North Carolina; Fort Wainwright Fire and Emergency Services, Fort Wainwright, Alaska; and Directorate of Combat Developments and Directorate of Training, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

Keeping the Mechanized Engineer Rolling

By First Lieutenant Don A. Nestor

The short-notice deployment of Bravo Company, 9th Engineer Battalion (Combat), to the Balkans in June 1999 presented numerous maintenance challenges for mechanized combat engineers. This article describes how a company executive officer addresses, manages, and attacks the mission of keeping mechanized engineers rolling. It also identifies some of the problems encountered when deploying a company and its equipment to a new area of operation before a forward support battalion (FSB) arrives.

Missions

With only five day's notice, Bravo Company transitioned from a 10-day, high-intensity rotation at the Combat Maneuver Training Center in Hohenfels, Germany, to a six-month peacekeeping deployment to Kosovo. As one of the first engineer units from the 1st Infantry Division to arrive in Kosovo, its work began immediately as the company helped lay the groundwork for the U.S. area of responsibility. Missions included road marches, mounted and dismounted patrols, berm construction, force-protection construction, and civilian convoy escorts.

During the first six weeks of deployment, the company compiled more than a year's worth of miles (600) on its vehicles and equipment. The high operating tempo (OPTEMPO) and constant vehicle use cost more than $300,000 for Class IX repair parts in less than two months.

Key to Success

Department of the Army Pamphlet 710-2-1, *Using Unit Supply Systems*, defines the prescribed load list (PLL) and describes procedures for managing it. The pamphlet states that a PLL is kept to support a unit's daily organizational maintenance operations. Normally this is for a prescribed number of days of supply, which depends on the average customer wait time.

The importance of a PLL is not truly realized until a unit must rely solely on its PLL parts to maintain vehicles and equipment. This became clear to Bravo Company during its first 30 to 45 days of deployment. With no full forward support battalion in Kosovo, parts flow was slowed to a trickle. Parts availability was limited to the company's PLL—which provided parts for about 25 days—and the prestocked major assemblies at Camp Able Sentry in Macedonia. PLL management is an important function because, during short-notice deployments, the PLL often must maintain the company for an extended period of time.

A unit's ground PLL is a combination of demand-supported (DS) and command-supported (CS) parts, not to exceed 150 lines. To be stocked as a DS line, a part must be requested at least nine times in a 180-day period. If a part meets this demand requirement, it is automatically added to the PLL. Then, to be retained, it must be requested six times in a 180-day period.

To combat the lack of parts acquired as DS lines, units are allowed to stock up to 15 CS lines. Battalion commanders must approve these lines in writing before they can be added to the PLL. This provides a means of stocking a part that is mission essential even though it does not meet the demand-supported criteria. Units should select CS lines carefully to ensure that necessary wartime stock is on hand for deployments.

Having a maximized PLL before deployment would have benefited Bravo Company tremendously. Due to the nature of its operations, the company's M113A3 armored personnel carriers, M998 high-mobility multipurpose wheeled vehicles (HMMWVs), and 5-ton trucks accrued the most mileage and required the most maintenance. Maintenance personnel observed that the vehicles' tracks and/or suspension sustained a great deal of wear and tear from constant use. However, the OPTEMPO during garrison operations was less than 600 miles over the course of a 180-day period, which did not build the demand history required to maintain a PLL capable of supporting the deployment.

Before deployment, the PLL was limited to 39 lines (24 DS and 15 CS). As a result, many of the track and suspension parts required to repair vehicles were not on hand. This operational constraint made it difficult to maintain vehicles according to –10/20 standards. An increased PLL that included but was not limited to the items in Table 1 would have been a combat multiplier during the initial stages of deployment.

Parts Flow

Althouth Bravo Company deployed with its Unit-Level Logistics System-Ground computer, the company did not have its original Department of Defense Activity Address

Table 1. Minimum Recommended Deployment PLL

NOUN	NIIN	Vehicle Type
Shock	01-028-8573	M113A3
Generator	01-238-9710	
Track Shoe	00-078-2908	
Road Wheels	01-139-3748	
Idler Wheel (Inner)	01-040-8855	
Idler Wheel (Outer)	00-856-2299	
Sprockets	00-141-1154	
Track Pads	01-130-3366	
Track Adjusters	00-403-6776	
Regulator	00-900-7993	
Fan Tower	01-319-2899	
Cooling Pump	01-320-0530	
Starter	01-188-7438	
U-Joints	01-356-9189	M998
Tire, Pneumatic	01-171-4746	
Parts Kit	01-382-8874	
Wheel Spindle	01-203-5764	
Generator	00-909-2483	
Track Shoe	01-234-1917	M9 ACE
Road Wheels	01-361-1764	
Generator Belt	01-291-5838	
Track Pads	01-156-8105	
Generator	01-264-6542	
Pump, Axial	01-158-4069	
Pulley	01-362-3577	
Starter	00-304-3493	
Generator	01-131-4931	HEMTT
Starter	01-139-3722	
Generator	00-830-6660	AVLB

NIIN = National item identification number

Table 2. Weekly Maintenance Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
0800-1600 1st Platoon's Maintenance (B809, B34)	0800-1900 HQ's Maintenance	0800-1600 A&O Platoon Maintenance	0800-1600 1st Platoon's Maintenance (B809-B34)	0800-1900 A&O Platoon's Maintenance		0900-UTC Bridge Maintenance Every Other Week
B1 Maintenance	B6 Maintenance	B801/B809 B255 Maintenance		B66 Maintenance	B7 Maintenance	B3 Maintenance
	1100-Company Maintenance Meeting	1600-Task Force Maintenance Meeting for XO				
	1300-1600- C&E /S&R Turn-In				1300-1600- C&E /S&R Turn-In	

UTC = until complete CE = communications and electronics SR = small-arms repair

Code (DODAAC) from Schweinfurt. Therefore all orders that were not received before deployment were no longer valid and consequently had to be reordered under a new DODAAC in Kosovo. This further prolonged the time it took for the company to receive replacement parts. The 299th FSB deployed to Kosovo about 30 days after the initial units, and the parts flow followed—but not instantaneously.

The great distances between the company, the forward support battalion, the initial staging base (ISB), and the direct-support unit in Germany drastically increased the travel time in the parts flow. When the company ordered a part, the request went to the 299th FSB at the main American base camp. These requests were forwarded to the ISB, which then sent them to the direct-support unit in Germany. Instead of having a direct link between the direct-support unit and the FSB, as in garrison operations in Germany, a third party was established at the ISB. This increased the amount of time between ordering and receiving parts.

Services

Without a deployable battalion service section, the responsibility for conducting vehicle services belonged to the company's maintenance section. The short-notice deployment to Kosovo created a backlog of five vehicle services originally scheduled for the second and third weeks of June. Overdue services from the home station in Schweinfurt and the OPTEMPO in Kosovo caused vehicles to break the Army's low-usage program. This created additional hours of work for the mechanics. The company developed a service schedule to continue troubleshooting and repairing its vehicles and servicing its equipment. Unfortunately, time could not be allowed for scheduling an entire two-week-block service for platoon vehicles, weapon systems, communications systems, and equipment. Instead, the service schedule permitted one vehicle and its respective equipment to be serviced according to –10/20 standards in a span of one week. The balance between services and troubleshooting vehicles became a major focus and an essential aspect of maintaining the company's fleet.

Split-Base Maintenance

Bravo Company's high OPTEMPO, geographic distance from the 299th FSB, and expanding area of responsibility resulted in split-base operations. With three platoons (two organic and one attached) operating in Bravo Company's sector and the company's fourth platoon attached to another unit, maintenance at the company level took on a new and difficult form. Initially, 1st Platoon was attached to a light infantry company team. According to the command and support relationship, this company team was supposed to provide 1st Platoon with mechanic support. However, the light infantry mechanics had little or no experience working on tracked vehicles, so the responsibility for troubleshooting and repairing the platoon's vehicles rested on the company's contact team. During the first few weeks of split-base operations, a three-man contact team encountered numerous problems while trying to maintain vehicles in three locations. The complications included the wear and tear sustained by the company's weapon and communications systems.

To overcome problems caused by split-base operations and satisfy operational requirements of individual platoons, a regulated maintenance schedule was developed that provided a balance between maintenance and missions. Table 2 shows a weekly schedule that allowed days for the contact team to travel in sector to the remote company sites and troubleshoot vehicles, weapons, and communications systems. The company also incorporated the 299th FSB's small arms and communications and equipment shops into its weekly maintenance schedule. The schedule

Soldiers from Bravo Company replace the track on an M577 command post vehicle.

provided mechanics with a clear focus of their work and allowed the platoons to address dispatching, small arms, and communications equipment problems.

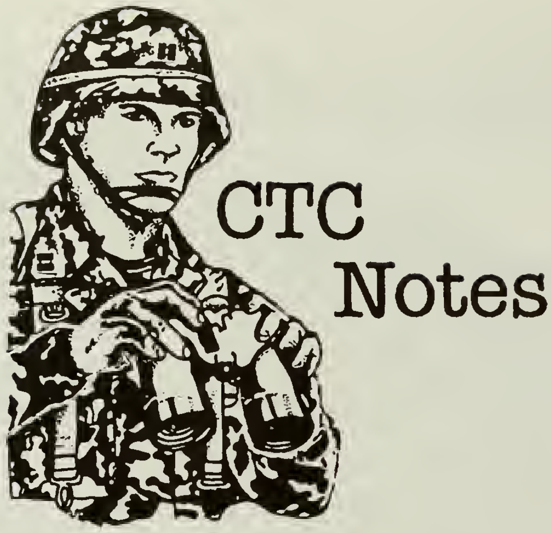
Lessons Learned

A valuable lesson learned during Bravo Company's deployment to Kosovo was the importance of staying on top of its PLL and ensuring that all lines were either on hand or on order at all times. A robust PLL at the company level would have improved the unit's ability to maintain its fleet to –10/20 standards. Reducing the demand criteria needed to stock a DS line on the PLL would have enhanced the company's operational readiness rate. An enlarged PLL would have provided parts to repair many of the company's vehicles. Furthermore, having more parts stocked on PLL would have greatly reduced or even eliminated the time required to receive parts during the first 45 days of deployment.

Summary

No one knows when he may receive a mission to deploy a company and its vehicles and equipment with less than a week's notice. Always plan for contingencies. Keeping the mechanized soldier rolling requires that an executive officer be constantly involved in establishing priorities, balancing and managing maintenance assets, and preventing overwork and consequent burnout of mechanics. *Duty first, maintenance always.*

First Lieutenant Nestor is the executive officer for Bravo Company, 9th Engineer Battalion (Combat). Previous assignments include combat engineer line platoon leader, battalion shop officer, and battalion motor officer. A graduate of the Engineer Officer Basic Course, 1LT Nestor holds a bachelor of science degree in mechanical engineering from the University of Notre Dame.



Battle Command Training Program (BCTP)

Synchronizing Engineers: Weighting the Main Effort in the Defense

By Lieutenant Colonel Ron Light

> *"The nature of water is that it avoids heights and hastens to the lowlands. When a dam is broken, the water cascades with irresistible force. Now the shape of an army resembles water. Take advantage of the enemy's unpreparedness; attack him when he does not expect it; avoid his strength and strike his emptiness, and like water, none can oppose you."*
>
> Sun Tzu, *The Art of War*

In the offense, doctrine tells us that "commanders attack to avoid the enemy's main strength." It should come as no surprise that the enemy seeks to do the same thing. As Sun Tzu noted, "the enemy flows like water, seeking the path of least resistance." However, sometimes engineers miss this point as they shape the battlefield during the defense. This article briefly reviews what it means to weight engineers in support of the defense.

Before exploring this concept, we must understand an important condition of the battlefield: the enemy is observing our defensive preparations. Wherever we have fought in the past and wherever we will fight in the future, the enemy is watching. During Warfighter exercises conducted by the Battle Command Training Program, the World Class Opposing Force (WCOPFOR) is adept at inserting special-purpose forces (SPF) throughout friendly forces' areas of operation. The WCOPFOR bases much of its plan on the information these SPF teams report.

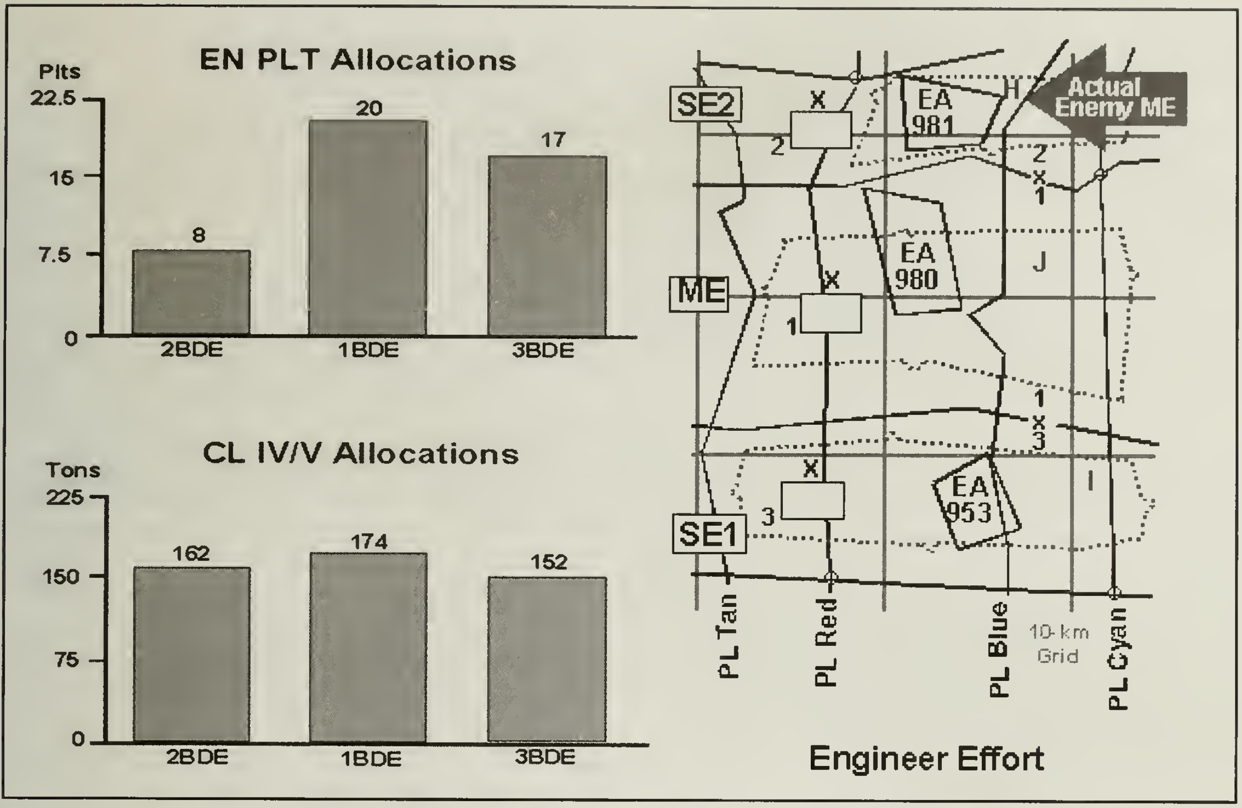
What do the SPF teams report during our preparations for the defense? Just as at the "dirt" combat training centers, the teams look for and report on the activities of friendly engineers. As an engineer once observed during a training rotation at the National Training Center, "Find his bulldozers, and you've found his defense." SPF teams are trained to look for engineers, armored combat earthmovers, and Volcano countermobility systems. With this information, the battlefield calculus to predict where our main defense effort is becomes relatively simple for the WCOPFOR. Simply stated, engineer activity is usually an accurate gauge to predict our main effort.

More often than not, friendly engineers make it far too easy for the WCOPFOR to identify the main effort. In the defense, engineer staffs weight the division's or corps's main effort (the force which will do most of the killing on the battlefield) with engineers. The main effort ends up in a strongpoint defense, and supporting efforts are relatively much weaker. As noted above, two things happen when this occurs. First, WCOPFOR SPF teams see this asset allocation, and they report accordingly. Second, the commander of the WCOPFOR uses this information to plan his attack against our weakness. More often than not, the WCOPFOR correctly reads where the friendly main effort is by identifying where the preponderance of friendly engineers are arrayed on the battlefield—and he attacks elsewhere. The enemy flows like water.

The figure on page 19 illustrates this point. The enemy was known to be attacking from the east. The division designated that 1st Brigade (in the center) was the main effort. This is where the division commander wanted the enemy to go and where he wanted to kill the enemy. In the north, 2d Brigade was a supporting effort, as was the 3d Brigade in the south. Notice, however, where engineers were arrayed on the battlefield. The bar chart in the figure shows that 1st Brigade received most of the engineer assets available: 20 engineer platoons. Moreover, 1st Brigade also received the largest allocation of Class IV/V (obstacle) barrier material: 174 short tons.

Recalling that the enemy is adept at reporting on our defense preparations, where do you suppose he attacked? Seeking to avoid friendly strength (easily read as 1st Brigade), and noting a relative weakness between the two supporting efforts, the enemy attacked into 2d Brigade in the north. The ensuing fight was quick and brutal.

By now it is probably obvious that *weighting engineers in the defense does not usually mean weighting the main effort with engineers.* The enemy will avoid our strength. One of the



Engineer Effort

primary ways he gauges our strength is by observing where we array engineer forces. We can deceive or mislead the enemy as to where our main effort is by weighting engineers to our supporting efforts.

Of course, we must allocate some countermobility assets to the main effort. Remember, however, that *doctrine urges commanders to mass effects, not necessarily assets.* We can allocate close air support and air Volcano missions to the main effort. These assets allow us to mass countermobility effects in a very short time. Moreover, with planning we can use these assets relatively late during our defensive preparations, when the enemy has less time to react. This technique was used effectively by a unit during a recent Warfighter exercise.

So what does it mean to "weight engineers in support of the defense?" Usually it does not mean making the main effort an impregnable force with all of the division's allocation of mines, wire, and pickets. What it does mean is creating a condition on the battlefield that confuses the enemy and causes him to commit his forces not against what he perceives to be our weakness but against our strength.

Lieutenant Colonel Light is the senior engineer observer/controller for the Battle Command Training Program at Fort Leavenworth, Kansas. He is scheduled to command the Honolulu District, U.S. Army Corps of Engineers, in July 2000.

Joint Readiness Training Center (JRTC)

The Engineer Survivability Execution Matrix

By Sergeant First Class Isaac N. Horton and Sergeant First Class Thomas V. Murray

We have observed a trend at the Joint Readiness Training Center concerning the engineer survivability execution matrix and how it impacts force-protection operations here and ultimately on the modern battlefield. The trend is that units employ the age-old blocked-time survivability execution matrix. This means that rather than conducting a detailed mission analysis, each unit with an established priority is allocated the same amount of time and engineer assets. The result is that the final product we observe routinely fails to adequately address force-protection requirements, link time and the resources available, and command and control engineer resources that execute force protection in support of the brigade.

The unit encounters many unnecessary challenges in executing these types of matrices and in protecting the force according to the commander's intent. Force-protection levels are not linked to enemy attack probabilities through the engineer battlefield assessment (EBA), and the unit's critical systems do not get the required level of protection. Ultimately, units suffer irreplaceable losses of mission-critical equipment and resources from enemy direct action that could have been prevented.

To be successful on the current lethal battlefield, units must protect critical systems, equipment, and supplies from enemy observation and attack. Units rotating through the JRTC struggle with planning and executing force-protection and survivability operations. This is due to incomplete EBAs and a lack of clearly defined doctrinal procedures for planning these types of operations at brigade level. Engineer company commanders and brigade engineers are doctrinally required to prepare detailed plans for survivability operations and include these plans in the brigade operations order (OPORD).

Technique

A brigade-level technique that engineer units can use to help improve their current system for calculating survivability requirements and preparing a survivability execution matrix consists of the following three steps:

Step 1: Identify key assets within the brigade.

Although time consuming, this is a simple process that must take place at home station. List battalion-level organizations and major company assets in matrix form. Figure 1 depicts a random selection of command- and-control nodes, weapon systems, and equipment in a typical light infantry brigade against the current task organization or the unit. The requirement matrix is a sample product that units must develop and implement at battalion level and use as the primary tool in calculating survivability requirements.

The construction times shown are not standard across the Army. The time required to construct protective positions varies from unit to unit. This is primarily due to the mission and the type of assets organic to that unit (such as D7 dozers, D5 dozers, deployable universal combat earthmovers [DEUCEs], loaders, small emplacement excavators [SEEs], or armored combat earthmovers [ACEs]) as well as the soil composition. The times should be established by timing—from start to finish, day and night—actual construction of the positions by two or more operators to get an average-time-required planning factor. We suggest that the times be established by using a single blade or single bucket rather than a blade team. Our example uses 15-blade work hours per day as a planning factor.

	Bde C2	Bn C2	Co C2	M998	5T/TPU	5T/SER	HEMMT	Inf Pit	105mm How	Q36/Q37	Sig C2	MTRS	FARP	VOLCANO	ATLS	ATP	M1A1	M3A3	M88	AVLM	FISTV	155mm How	AVENGER	30KW Gen	5K Tanker	Avn HELO	M113A3	Aid Sta	FIST/FO	Stinger	Dragon	DM/TOW	ATD	P/Berm	Misc	MiSc
Time in Minutes	150	120	60	45	60	60	90	120	90	90	120	45	150	90	60	120	150	90	90	90	45	150	30	15	120	90	30	30	15	15	15	45	60 MH	70 MH		
Bde																																				
2-35 Inf																																				
4-4 Inf																																				
1-82 Inf																																				
1-21 Cav																																				
A 1-4 FA																																				
B 1-4 FA																																				
120 FSB																																				
HHC Bde																																				
B 2-45 AR																																				
C 2-45 AR																																				
C 19 Sig																																				
A 22 En																																				
1/A 237 En																																				
3-22 ADA																																				
54 Chem																																				
3/45 MP																																				
2384 CSG																																				
78 Med																																				
42 CSH																																				
214 MI																																				
Total																																				
D7																																				
SEE																																				

Figure 1

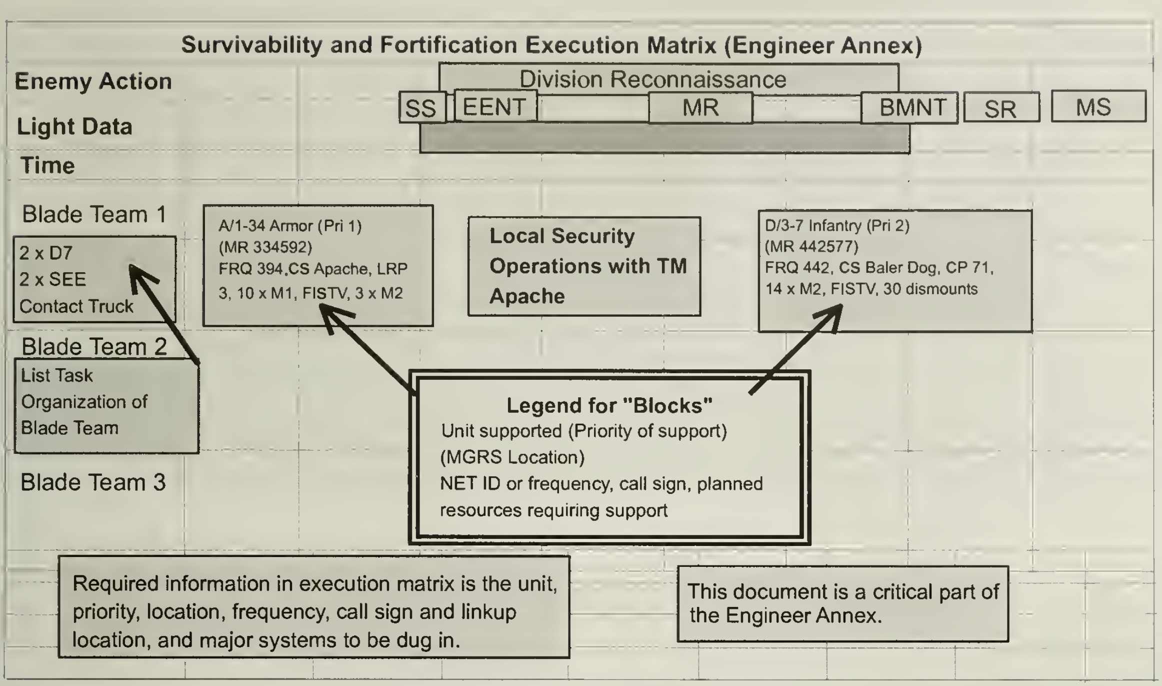

Survivability and Fortification Execution Matrix (Engineer Annex)
Enemy Action
Division Reconnaissance
Light Data
SS
EENT
MR
BMNT
SR
MS
Time
Blade Team 1
2 x D7
2 x SEE
Contact Truck
A/1-34 Armor (Pri 1)
(MR 334592)
FRQ 394,CS Apache, LRP 3, 10 x M1, FISTV, 3 x M2
Local Security Operations with TM Apache
D/3-7 Infantry (Pri 2)
(MR 442577)
FRQ 442, CS Baler Dog, CP 71, 14 x M2, FISTV, 30 dismounts
Blade Team 2
List Task Organization of Blade Team
Legend for "Blocks"
Unit supported (Priority of support)
(MGRS Location)
NET ID or frequency, call sign, planned resources requiring support
Blade Team 3
Required information in execution matrix is the unit, priority, location, frequency, call sign and linkup location, and major systems to be dug in.
This document is a critical part of the Engineer Annex.

Figure 2

Step 2: Prepare an engineer work estimate.

Record the time available, the number of dozers or SEEs available, and the brigade commander's priority for survivability effort. FM 5-103, *Survivability*, states that maneuver commanders should set survivability priorities based on the engineer's input and recommendation (which is based on an updated and accurate EBA) and mission analysis with the brigade staff. It is at this point that the blocked-time matrix is normally developed. This can be avoided if units have a system for accomplishing the detailed planning necessary for preparing a brigade-level survivability timeline.

Step 3: Prepare the survivability execution timeline.

This timeline (better known as the "missing link") must be a collective effort of the engineer commander, the assistant brigade engineer, and the equipment platoon leader. The document, which is paramount to the engineer annex in the brigade OPORD, is often omitted. This may cause the brigade's force-protection levels to be substandard. Figure 2 depicts the 80 percent solution for a detailed survivability execution timeline. At a minimum, the information in the matrix should include the supported unit, priority, location, frequency and call sign, and work estimate. As stated earlier, the timeline *must* be included in the maneuver brigade and battalion base orders. When properly planned and included in the base order, conflicts can be avoided during execution of the engineer's survivability timeline.

Conclusion

By conducting a comprehensive EBA and implementing this three-step technique, engineer survivability planners communicate the critical path for executing the commander's priorities of force protection. The execution timeline provides the means to command and control survivability operations through time and space based on identification of key assets and the engineer work estimate process. The end result is that blade utilization is maximized in a prioritized and efficient manner. By protecting critical weapon and sustainment systems, the ability to deliver combat power and achieve mission success is dramatically increased. *No idle blades.*

SFC Horton and SFC Murray are observer/controllers at the Joint Readiness Training Center, Fort Polk, Louisiana, where their focus is to teach, coach, and mentor engineer leaders at all levels concerning force-protection and survivability operations on the Army's battlefields.

Sets, Kits, and Outfits:
Bridging, Diving, Lighting, and Fire-Fighting

By Alan Schlie

In the third of four articles on sets, kits, and outfits (SKO), the focus is on bridging, diving, lighting, and fire-fighting tools. The first article discussed tool sets for construction trades. The second article concentrated on pioneering, mine warfare, and demolition tools. The fourth article will feature tools for the technical trades and topography.

Bridging

If you've been around long enough to remember light tactical rafts and the dry span with universal trestles, then you'll be glad to know they've been placed in depot stocks and are used only in the most extreme emergencies. In addition to providing a means for crossing wet and dry gaps, these older bridging sets provided a perfect opportunity for building unit cohesion, teamwork, and esprit de corps.

Engineers have always been expected to bridge gaps without restricting the speed of the maneuvering element, and the bridges are expected to handle increasingly heavier loads, yet involve fewer soldiers in the construction effort. To realize these expectations, the interdependent spheres of mission, enemy, terrain, troops, and time available (METT-T) must be handled with a delicate touch. The U.S. Army Tank-automotive and Armaments Command (TACOM) Bridge Engineering Division has been juggling those glass balls for a long time, pushing the development of lightweight metals and laminates by commercial suppliers and overcoming the dwindling manufacturing base to ensure that Army needs are met and that every promising candidate is fully explored. The research and development work begun by the Fort Belvoir Research and Development Center continues at TACOM's Research and Development Engineer Center in Warren, Michigan.

The assault float bridge, or ribbon bridge (not an SKO), was fielded in the 1970s and eventually replaced all float bridging assets in table of organization and equipment (TOE) units. It is now being upgraded to increase buoyancy and military load class (MLC) in faster stream velocities. The assault float bridge can be assembled at the rate of 210 feet per hour by the same soldiers who deliver it to the bridge site. It carries MLC 70 in current velocities of 7 feet per minute. Multirole bridge companies retain the **Supplemental Bridge Set** for constructing overhead anchorage systems.

The **Float Bridge Sets** that have been replaced include various lengths of M4T6 and MLC 60 floating bridges, their corresponding bridge-erection sets, ferry conversion and dry-span sets, light tactical raft sets, and aluminum floating foot bridge sets. All the older bridges will be stored in set configuration and available for humanitarian as well as military needs.

The **Medium Girder Bridge (MGB)** (bridge, erection, and reinforcing sets) was developed to replace the M2 Bailey bridge (bridge, erection, cable reinforcing, and pier conversion sets) in 1972. The MGB is available in sufficient quantities for all 20 multirole bridge companies—only at a reduced authorization. About 150 Bailey sets

Soldiers launch a 70-foot double-double Bailey bridge by hand.

A diver cuts concrete with the hydraulic chain saw, a component of the Underwater Construction Set.

will remain in depot stock with another 100 bridges erected or stockpiled in numerous countries around the world. Current stocks of MGB sets are being overhauled at the rate of 10 sets per year. The depot work includes inspection, structural repair, and repainting. Twenty-eight soldiers can construct 46 meters of MLC 60 MGB in 3 hours.

The **Heavy Dry Support Bridge (HDSB)** is being developed to replace the MGB and in a limited role as a line of communications (LOC) bridge until a final design is determined for the LOC. The HDSB is a marked improvement over other prefabricated fixed bridging systems because it can be constructed at the rate of 40 meters in 90 minutes by 14 soldiers and can carry MLC 96W/70T. The HDSB is programmed for fielding in 2002.

Diving

Proponency for U.S. Army divers resides with the Engineer School. All divers are trained at the Naval Diving and Salvage Training Center, a joint service training command located in Panama City, Florida. And while diving equipment for engineers and Special Forces is similar, the two groups have different mission requirements for tool sets. Army divers' underwater missions involve reconnaissance, demolition, hydrographic surveying, obstacle emplacement, inspection, repair, light and heavy salvage, and recovery. They also conduct dam, levee, and lock inspections for the Corps of Engineers.

To accomplish those tasks, there is a myriad of diving sets, supporting sets, tool sets, and ancillary equipment. Diver equipment sets allow surface-supplied diving to depths of 250 feet or self-contained (scuba) diving to depths of 190 feet, thermal and physical protection, depth monitoring, regulating gauges, communications equipment, lights, and video recorders. **Surface-Supplied Lightweight Diving Sets** are scheduled for procurement in 2000 and 2001. **Scuba Diving Sets** are tentatively scheduled for procurement in 2008.

Supporting equipment sets consist of specialized high and low air compressors for tank and flask filling or supplying surface air, gas-analysis kits, and hyperbaric recompression chambers. The **Special Divers Air Support System (SDASS)** is the first of engineer diving equipment in the Force XXI modernization plan that supports a modularization concept. The SDASS supports extended diving operations by accepting air from any of three sources and properly distributing it to one, two, or three divers at depths of 250 feet. It provides constant depth monitoring of the divers by topside support personnel. The SDASS also supports the recompression chamber and is scheduled for procurement in 2004.

The **Underwater Construction Set** contains four subpackages. Each can be used independently, allowing diving teams to tailor equipment loads based on mission requirements. The first is a hydraulic tool package used for constructing; removing debris; and cutting concrete, wood, and metal. The second is a cutting and welding package for both surface and underwater operations. The third is a salvage package for lifting heavy debris and recovering objects weighing up to 80,000 tons. The fourth contains hand tools, hardware, and equipment used to locate and mark underwater obstacles. All components can be used in freshwater or saltwater to a depth of 250 feet. Procurement of the Underwater Construction Set began in 1999.

Ancillary equipment includes 3-man reconnaissance boats and 7- and 15-man inflatable assault boats. All are fabricated from neoprene-coated nylon fabric; have a rigid stern for mounting an outboard motor; and are issued with paddles, air pumps, and a repair kit. Procurement for the 15-man boat is underway with additional purchases for all three beginning in 2002. A replacement 35-horsepower outboard motor is also scheduled for fielding in 2002. The motor is hand-startable, uses a gas/oil-mix fuel, is capable of being sound suppressed, and can be restarted within 10 minutes after being submerged. An **Underwater Photography Support Set**, based on digital technology, will enhance the divers' reconnaissance, inspection, and damage-assessment capabilities in the future.

A senior enlisted diver in the Materiel Branch of the Maneuver Support Center's Directorate of Combat Developments works closely with the civilian diving community, the Naval Diving and Salvage Training Center, and the item managers at TACOM Armament and Chemical Acquisition and Logistics Activity, Rock Island Arsenal, Illinois, to modernize diving equipment. The overall number of diving sets needed is small compared to other systems, but providing breathable air to—and completing vital underwater missions by—Army divers requires the best equipment that technology has to offer and an aggressive modernization plan.

Lighting

The Engineer School is the proponent for temporary and portable illumination for airfields and heliports; tents, camps, and other facilities; and construction projects. Item managers at the Communications-Electronics Command, Fort Monmouth, New Jersey, oversee the development, procurement, and fielding of more than 23,500 portable/temporary lighting sets that are found in all types of units.

Lighting sets provide temporary illumination for tents, camps, buildings, command posts, tactical operation centers, hospitals, and other structures and facilities. Electrical power is provided directly by generators and/or local power grids or by rechargeable batteries. Safety (electrical-shock protection and circuit-overload prevention) is a primary concern along with the capability to reduce the light signature. Electrical power distribution in bivouac areas is normally provided by the Distributed Illumination System-Electrical components authorized to the unit.

Special-purpose lighting sets with uniquely designed lighting units are available for emergency lighting of small tactical air strips and landing sites and temporary lighting of 2,000 linear feet of runway or a 200-square-foot helipad for operations under combat conditions. These lights are lightweight, portable, and battery-powered; flash with high-intensity horizontal and vertical beams; have multicolored, interchangeable domes; and are anchorable.

Floodlight Sets provide lighting for perimeters; guard towers; security; prisoner of war camps; logistic sites; and nighttime construction work on airfields, roads, pipelines, ports, or logistics-over-the-shore sites, quarries, and batch plants. The Floodlight Set is planned for procurement beginning in 2000.

As the light sets are reviewed, changes will be implemented to make the systems safer and eliminate lead-acid batteries, increase the operating life of the batteries by changing the recharging characteristics, and develop more options for recharging/operating sources. As development funds become available, the sets will be updated based on the military adaptation of some commercial products.

Fire-Fighting

The multipurpose fire-fighting vehicle was procured for use by the armed forces to provide fire-fighting capability for protection of military installations and aircraft, whether at home base or the forward tactical operations area. The military-adapted commercial item (MACI) fire-fighting vehicle functions equally well when fighting structural fires, combating fuel fires, or suppressing brushfires. The MACI replaced all configurations of the 530-series fire trucks—crash-rescue, brushfire, and structural-fire—currently in the field. The MACI was fielded in 1988-89 and has an on-board, 750-gallon water-storage capability; seating for a four-soldier crew; and a foam proportioner. The MACI set is currently managed by TACOM.

A replacement for the MACI is programmed for 2003, assuming testing and final selection are completed by then. The requirement is to have an increased water- tank size (1,000-gallon), seating for a crew of six soldiers, a foam proportioner, blackout lights, M16 rifle holders, and four-wheel drive; and be able to ford to depths of 0.75 meters. It will carry a 3-cubic-feet-per-minute air compressor for refilling air tanks and for use with inflatable jacks. In addition, it will contain a full set of hoses, ladders, tools, and crash-rescue/survival equipment.

Summary

As stated in the first article of this series (*Engineer*, August 1999), each soldier uses one or more sets, kits, or outfits containing either the tools of the trade or to support numerous other tasks from field feeding to maintenance to communication. The next time you discover that you don't have the right tool or enough tools—or if the tool doesn't work—tell your supervisor and then call the Maneuver Support Center Directorate of Combat Developments. Make your tool sets work for you. Send comments to the Organization Branch (Tom Knotts or Alan Schlie), 320 Engineer Loop, Suite 141, Fort Leonard Wood, Missouri 65473-8929. Telephone numbers are commercial (573) 563-6191, DSN 676-6191, and fax (573) 563-5056. The e-mail address is *schliea@wood.army.mil.*

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Army Safety Augmentation Detachment:

Making the Difference in Today's Mission

By Lieutenant Colonel (Retired) Bill Ramer and Fred Fanning

Army Safety Augmentation Detachment (ASAD) personnel are an essential piece of the Total Army safety and can be a priceless addition to any deployment mission—whether for war, peacekeeping, or training. The key is to know whom they are and how to get them on your team. The information in this article will help engineer unit commanders and staff officers prepare and execute missions by identifying a source for safety support.

In the fall of 1995, the Dayton Peace Agreement on Bosnia-Herzegovina was moving toward approval. A NATO-commanded multinational military Implementation Force (IFOR) would monitor and help ensure compliance with the agreement on military aspects and fulfill certain supporting roles.

In Bosnia-Herzegovina, an American Army general commanded both the Multinational Division North and Task Force Eagle. Included in the division were a Nordic-Polish Brigade, a Russian Brigade, a Turkish Brigade, and an American Brigade and Aviation Regiment. This multinational mission had unique requirements, and civilian safety personnel played an important role in helping commanders and leaders implement a safety program that supported the requirements. However, there were not enough of these personnel to cover all areas and to stay on the job for the hours, days, and months that they were needed. Most engineer units do not have their own organic civilian safety personnel, and it may be difficult to obtain support from the civilian safety personnel assigned at division and corps levels. The solution for Task Force Eagle was Army reservists from the Army Safety Augmentation Detachment.

ASAD personnel are individual mobilization augmentees with the U.S. Army Reserve. They are officers and warrant officers assigned to the U.S. Army Forces Command (FORSCOM) Safety Office. These personnel receive basic training and education in tactical and operational safety.

ASADs bring to an operation the experience of their military background from active duty, reserves, and National Guard. Since they are still active soldiers, their perspective is focused on the needs of their fellow soldiers as well as the need to support the mission. Their training helps to focus this effort and join with the civilian safety personnel (when available) and the ongoing safety program of the deployed unit. This tie-in is critical and will allow the ASAD to join an already-formed team and contribute to the effort to improve hazard identification and control-measure implementation.

ASADs have served during Operations Joint Endeavor, Joint Guard, and Desert Storm, as well as operations in Haiti and Somalia. ASAD personnel in Bosnia-Herzegovina, Croatia, and Hungary provided continuous operational safety support to U.S. forces traveling to and from and operating in Bosnia-Herzegovina. Using these personnel was a critical element from the time they began training until they reported for duty. Since each unit makes a choice about where its safety program is established in the command structure, ASAD training stresses the need for adapting operational safety to the command structure and the constantly changing operational environment. They work for the unit or task-force commander, and their bottom line is protecting the soldier and thereby protecting the force.

The utility of ASADs is seen best in their ability to provide a command with operational military safety personnel with field experience. They do not implement the unit safety program—they enhance and sustain it. They provide safety staff officers at the brigade, division, and corps levels. Statistics indicate that soldiers in Operation Joint Guard were actually safer in theater than in their respective garrisons in Germany and CONUS. Seventy-five percent of the Army's casualties are "self-inflicted" through accidents. ASAD personnel are the only staff officers whose sole focus is reducing these incidents and sustaining the ground combat power available to the ground commander. They are proud to have been there. The Task Force Eagle motto says it all: *Protect the soldier, protect the force!*

If commanders are interested in ASAD support for their next mission, operation, or training event, it is essential that they understand the program and the support that can be provided. An official request must be sent through the chain of command to the FORSCOM Safety Office. It is also essential that the unit Reserve Liaison Officer be involved. There are specific requirements for which ASAD support can be used, and in some instances a presidential call-up must occur before support can be provided. In addition, in some cases there may be costs incurred by the unit for this support. The best approach is to outline the specific requirements of the unit and make a formal request to the FORSCOM Safety Office to provide the costs and availability of ASAD personnel. For Operations Joint Endeavor and Joint Guard, the time and effort spent getting ASADs approved and on the ground were well worth it.

E-mail comments or questions to *fanningf@wood.army.mil*, or call him at (573) 596-0116.

* * *

Lieutenant Colonel Ramer was a member of the Army Safety Augmentation Detachment in Bosnia-Herzegovina. He served as a safety officer with the 1st Armored Division and the 1st Infantry Division.

Fred Fanning, a certified safety professional, is safety director of the Maneuver Support Center at Fort Leonard Wood, Missouri. He served as safety director for the U.S. Army V Corps during the first two and one-half years of the Stabilization Force operations in Bosnia-Herzegovina.

Ohio Engineers Get "Stick Time" at Selfridge:

A Mutually Beneficial Relationship Continues

By Rae Higgins

Sports fans have long known about the famous Michigan-Ohio State football rivalry. But there's no rivalry between units at Michigan's Selfridge Air National Guard Base and the Ohio Army National Guard's 216th Engineer Combat Battalion (Heavy). In fact, there's reason to cheer because military units headquartered in both states joined forces in 1998 to begin a comprehensive, ongoing quality-of-life project that continues to be mutually beneficial. For the second year, soldiers from the 216th reported for two weeks of annual training at Selfridge beginning in late July.

The U.S. Army Garrison-Selfridge, which is a business element of the Tank-automotive and Armaments Command (TACOM)-Warren, is one of the active duty units at Selfridge. Despite the fact that Selfridge is an Air National Guard base, it is home to soldiers, sailors, airmen, marines, coastguardsmen, and their families. The Army garrison is charged with infrastructure maintenance, which includes housing, morale, welfare, and recreational activities.

Mission

The 216th's mission is to provide general engineering with limited mobility, countermobility, and survivability tasks. Its soldiers must construct, repair, and maintain supply routes, landing strips, buildings, structures, and utilities. As an organization of citizen-soldiers, the unit provides these services both to the people of Ohio and to the nation.

According to TACOM's National Guard adviser, hosting the unit's annual training is a major mutual endeavor. Not only does Selfridge gain new facilities at a minimal cost, but the Ohio Army National Guard receives valuable training as well.

Units from the 216th that reported to the U.S. Army Garrison-Selfridge for Annual Training '99 included Alpha Company, headquartered in Chillicothe; Charlie Company, based in Youngstown, and its Detachment 1 out of Camp Perry; and Battalion Headquarters Support Company, from Hamilton, and its Detachment 1 from Felicity.

This past year's stint at Selfridge was especially challenging for the 216th to plan because the majority of the battalion's personnel were called up to assist with hurricane relief operations in Nicaragua. In addition, 50 soldiers from Alpha Company were deployed to Korea. Hence, the annual training team could not be identified (from the aforementioned units) until the first day of training. The battalion held daily training meetings to ascertain how to overcome the obstacles that cropped up and forged ahead with the work at hand.

Annual Training '99

Annual Training '99 built upon the engineers' 1998 project, which centered chiefly on "vertical work"—building five picnic pavilions in a park along one of Selfridge's shoreline areas.

The project in 1999 was more comprehensive, however, as the units got to really roll up their sleeves and focus on "horizontal" work. Their goal was to build a recreational vehicle campsite in the park.

In all, the 216th's soldiers racked up some good stick time, indeed. Their major accomplishments included installing nearly 1,500 feet of 6-inch water main to deliver water to 30 recreational vehicle campsites; emplacing two fire hydrants to satisfy fire codes; placing base-course materials in the main road to the sites and a vehicle turnaround; and grading the campsite area.

According to the Garrison - Selfridge commander, the garrison provided the battalion with $37,000 worth of materials and received $110,000 worth of construction work this year.

When completed, the recreational vehicle park will be open to active duty service members, retirees, National Guard and Reserve members, Department of Defense civilians, and eligible family members. The park will be managed by the Directorate of Morale, Welfare, and Recreation, and officials hope it will become a money-making operation. If the park is successful, Selfridge officials will consider building more recreational vehicle campsites. A rustic campground project might even be in the works.

The measurement of an exercise such as this is the kind of training soldiers get. The exercise increased the overall readiness of the battalion by giving soldiers an opportunity to hone their military occupational specialty skills. Despite the less-than-ideal circumstances at the outset, in the end it all paid off. Heavy equipment operators received a lot of stick time, and the troops were not only able to pull vehicle maintenance but also to cross train and increase the skill proficiency of junior enlisted soldiers. Cross training is an essential element of the battalion's work. It became especially important because the annual training team was "piecemealed" together due to the Nicaragua mission. For this project, the plumbing teams consisted of about 20 carpenters who cross trained as plumbers.

When complete, this shoreline area will be home to a recreational vehicle campsite complete with electrical and water hookups.

The 64 soldiers who participated in the Selfridge Annual Training '99 came from all walks of civilian life—among them students, plumbers, corrections officers, and business owners. Whatever their civilian profession, they were all motivated for annual training and eager to work and learn.

One sergeant who had previously spent seven years on active duty logged her first annual training with the National Guard at Selfridge. The veterinary technician said she learned a lot while in Michigan, such as surveying, driving trucks, and laying pipe. As one of the few women participating in the annual training, she said that today's Army offers more opportunities for women than when she was on active duty. The Boston native said she and the other women in the battalion were doing the same kind of work and received the same kind of treatment as their male counterparts.

A loader operator from the Headquarters Support Company, a private residential construction worker in civilian life, was able to spend all-important time using his loader to fill 5-ton trucks with dirt that the dozer operators had dug, moved, or cleared. He emphasized that it is always good training for the unit whenever you can get on your equipment. The site noncommissioned officer in charge agreed. The 16-year Guard veteran, who had just returned from Nicaragua, said that annual training rotations provide opportunities for soldiers to gain crucial experience. These types of projects provide realistic training for tasks the unit might encounter on the battlefield.

The Benefits

The Selfridge-Ohio National Guard partnership proved to be a win-win situation any way you look at it. The battalion worked projects that have real-world application on the battlefield, so it maintains readiness by sharpening soldiers' skills. The garrison and the Selfridge community as a whole not only get new or improved facilities and a significant quality-of-life upgrade, but they also get them for a bargain. It was great training for the Ohio Guard engineers and great savings for the government and it gave folks great facilities to enjoy.

Bo Schembechler, the University of Michigan's fabled former gridiron skipper, and legendary ex-Ohio State football coach Woody Hayes wouldn't even argue with that.

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The Corps and the Canal

By Dr. James W. Dunn

The U.S. Army Corps of Engineers did not build the Panama Canal. It was built by the Isthmian Canal Commission (ICC), which was authorized by the Spooner Act and appointed by the President of the United States. However, Army engineers became involved in the U.S. interest in building a canal in 1870 when President Ulysses S. Grant, stimulated by the opening of the Suez Canal in 1867, ordered the U.S. Navy to conduct surveys of possible canal routes in Central America. The Navy reported to an Interoceanic Canal Commission whose membership included Chief of Engineers Brigadier General Andrew A. Humphreys.

The spillway, looking north from the west wall. Foundations for valve and cofferdam piers are in the foreground.

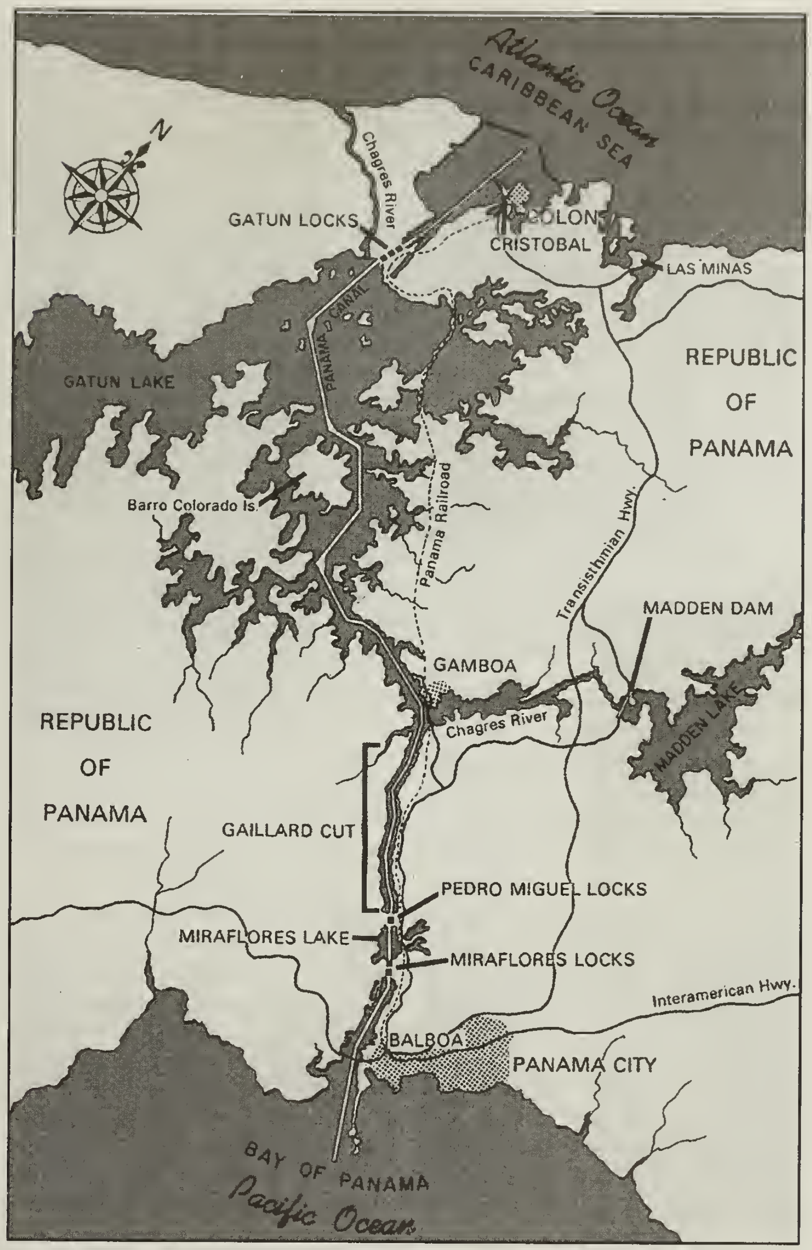
The United States was following the path of earlier Spanish interest in the possibility of a canal trade route somewhere in Central America. Spanish explorer Vasco de Balboa walked across the Isthmus of Panama to the Pacific Ocean in 1513, and in the middle of the 16th century a Spanish Catholic priest, Father Francisco de Gomara, wrote a book about a canal in either Nicaragua or Panama. However, it was not until the 18th century that the Spanish conducted surveys of potential routes. In 1787 Thomas Jefferson, the U.S. minister to France, made an unsuccessful attempt to obtain those survey reports.

From the middle of the 19th century, the United States made increasing use of the Panama isthmus as settlers moved to the new lands gained in the Mexican War, and gold seekers rushed to the California mining sites. In 1850 a U.S. company obtained the right to build a railroad across Panama and completed a one-track line in 1855. Among those who crossed from the Atlantic to the Pacific in those mid-19th century years was Captain Sam Grant, when he moved his family in 1852 to his assignment with the 4th Infantry Regiment in Oregon.

After studying the Navy survey reports in the early 1870s, President Grant's Interoceanic Canal Commission concluded that the Nicaragua route was better than Panama because of the high cost of a lock canal through the Isthmus of Panama and the threat of yellow fever and malaria there. However, before the United States could get started, Ferdinand de Lesseps, builder of the Suez Canal, formed a French company to build a sea-level canal in Panama. The Universal Interoceanic Canal Company began work in February 1881, and by midsummer the first yellow fever and malaria cases were reported. There were 125 deaths in 1882 and 420 in 1883. By 1889 de Lesseps' company was bankrupt, and work on the canal came to a halt; the cost of a sea-level canal was too high, and the yellow fever and malaria threat was too great.

While the French struggled in Panama, the United States Maritime Canal Company—which included retired General George B. McClellan, who had entered the Corps of Engineers upon his graduation from West Point in 1846—obtained a concession to build a canal in Nicaragua. Several attempts in the 1880s and 1890s resulted in failure due to high costs and the inability to hire a reliable work force. The U.S. and French failures indicated that private industry could not succeed alone; an interoceanic canal in Central America needed government support.

In 1895 President Grover Cleveland appointed a three-member Nicaragua Canal Board to study and compare the two routes—Panama and Nicaragua. The Ludlow Commission, named for Army engineer member Lieutenant Colonel William Ludlow, recommended continued study of the Nicaragua route. To do so, in 1897 President William



Map of the Panama Canal Zone

McKinley appointed a Nicaragua Canal Commission. It included Professor Lewis M. Haupt of the University of Pennsylvania, who graduated from West Point in 1867 and entered the Corps of Engineers, and Army engineer Colonel Peter C. Hains. That commission also recommended Nicaragua.

The U.S. interest in Nicaragua concerned the French company, which still held the de Lesseps' concession to build a canal in Panama and was interested in selling it to the United States. In 1896 the French hired a New York lawyer, William Nelson Cromwell, as a lobbyist for their renamed New Panama Canal Company. He, in turn, hired retired Army engineer Brigadier General Henry L. Abbot as a technical expert. Abbot wrote a report citing the advantages of a lock canal in Panama over a sea-level canal in Nicaragua.

The Spanish-American War illustrated to the American public the need for some type of canal in Central America when it took the battleship *Oregon* more than 60 days to go from San Francisco to the Caribbean by way of Cape Horn. In December 1898, the French made an official approach to the United States about buying the concession rights of the New Panama Canal Company.

To sort this all out, Congress appropriated $1 million to fund an Isthmian Canal Commission to recommend either Panama or Nicaragua as the route for an interoceanic canal. The ICC included Haupt and Hains from the previous commission and Army engineer Lieutenant Colonel Oswald H. Ernst. When the November 1901 report recommended Nicaragua because it was cheaper than Panama (the New Panama Canal Company valued its assets at $100 million), the French hired Philippe Bunau-Varilla to support Cromwell's lobbying efforts in the United States. Bunau-Varilla was a French engineer who had worked for de Lesseps in Panama and was a shareholder in the New Panama Canal Company. While Bunau-Varilla talked about the advantages of Panama over Nicaragua—such as better harbors, a shorter route, and an operating railroad—he also got the New Panama Canal Company to revalue its assets at $40 million. That made Panama cheaper than Nicaragua, and an amended ICC report in January 1902 recommended the Panama route.

With that report Senator John C. Spooner successfully sponsored an amendment to turn a Nicaragua bill into a Panama bill. The Spooner Act, signed into law by President Theodore Roosevelt on 28 June 1902, authorized purchase of the New Panama Canal Company for $40 million, purchase of a zone in Panama for construction of a canal, and set up a seven-member presidential-appointed Isthmian Canal Commission to build the canal. In the March 1903 Hay-Herran Treaty, the United States and Colombia (which owned Panama) agreed on the purchase price for the French company and payment of $10 million by the United States to Colombia for the right to build a canal in Panama. By August that treaty was a dead issue, as Colombia wanted more than $10 million from the United States and some of the $40 million going to the French company.

Fearful that the United States would go to Nicaragua, Panamanians interested in having the canal built across the isthmus approached Bunau-Varilla. Acting as their representative, Bunau-Varilla talked with officials in Washington and then promised the Panamanians U.S. support in the event of a revolt and break with Colombia. After an almost bloodless revolt on 3 November, Panama declared itself a republic on 4 November. In the early morning of 6 November, Army engineer Major William M. Black, at the request of the Panamanians, raised the flag of the new republic over the city of Colon.

Major Black and Army engineer Lieutenant Mark Brooke were in Panama as representatives of the ICC to study and report on the New Panama Canal Company in anticipation that Colombia would agree to the Hay-Herran Treaty. Both engineer officers remained in Panama into1904, with Black as acting chief engineer and Brooke signing for transfer of the New Panama Canal Company property to the United States on 4 May 1904.

Bunau-Varilla, as Panamanian envoy to the United States, signed the Hay-Bunau-Varilla Treaty on 18 November 1903. The United States purchased from Panama a 10-mile zone across the isthmus for $10 million and $250,000 annually, guaranteed Panama's independence from Colombia, and paid the French $40 million for the New Panama Canal Company. After Panama ratified the treaty in December 1903 and the U.S. Senate did so in February 1904, President Roosevelt—as required by the Spooner Act—named a seven-member ICC to build the canal. The ICC included Colonel Hains and Lieutenant Colonel Ernst.

The first ICC chief engineer was John F. Wallace, who was a railroad engineer and general manager of the Illinois Railroad when he took the job to build the canal. He arrived in Panama to take over from acting chief engineer Major Black in July 1904, but he resigned a year later. He was fearful of the yellow fever threat and attracted by a better-paying job in the United States. Railroad engineer John Stevens—an executive with the Chicago, Rock Island, and Pacific Railroad—replaced Wallace and arrived in Panama in July 1905. He remained longer than Wallace and was successful in building a solid infrastructure that included worker and family quarters. His railroad excavation system functioned like a conveyor belt with the trains carrying the dirt from the steam shovels directly to the dump sites.

Stevens was ready to dig in 1906, but the type of canal—sea-level or lock—remained a question. Wallace had recommended a sea-level canal, but Stevens favored a lock canal. A 13-member board of consulting engineers recommended, by an 8-5 margin, a sea-level canal, but the ICC accepted the minority report for a lock canal written by retired Army engineer Brigadier General Henry L. Abbot. The plan President Roosevelt signed into law in June 1906 called for a canal with three locks on the Atlantic side, three on the Pacific side, and a lake in the middle created by damming the Chagres River at Gatun.

Stevens never got very far with this plan because he resigned in February 1907. His strength was as a railroad construction engineer, and by 1907 the conveyor-belt-type railroad system was in place. What awaited Stevens was hydraulic engineering: the design of dams and locks and the large-scale use of concrete. That was not his strength, but it certainly was the strength of Army engineers in the U.S. Army Corps of Engineers. Thus, it was to the Corps that President Roosevelt looked to get someone who could not quit.

On 18 February, Roosevelt summoned Army engineer Major George W. Goethals to the White House for an interview and, on 26 February, he announced that Goethals was going to Panama as chairman of the ICC and chief engineer to complete construction of the Panama Canal. As a member of the Army General Staff, Major Goethals had accompanied Secretary of War William Howard Taft to the Canal Zone in 1905 to recommend sites for coast defense fortifications.

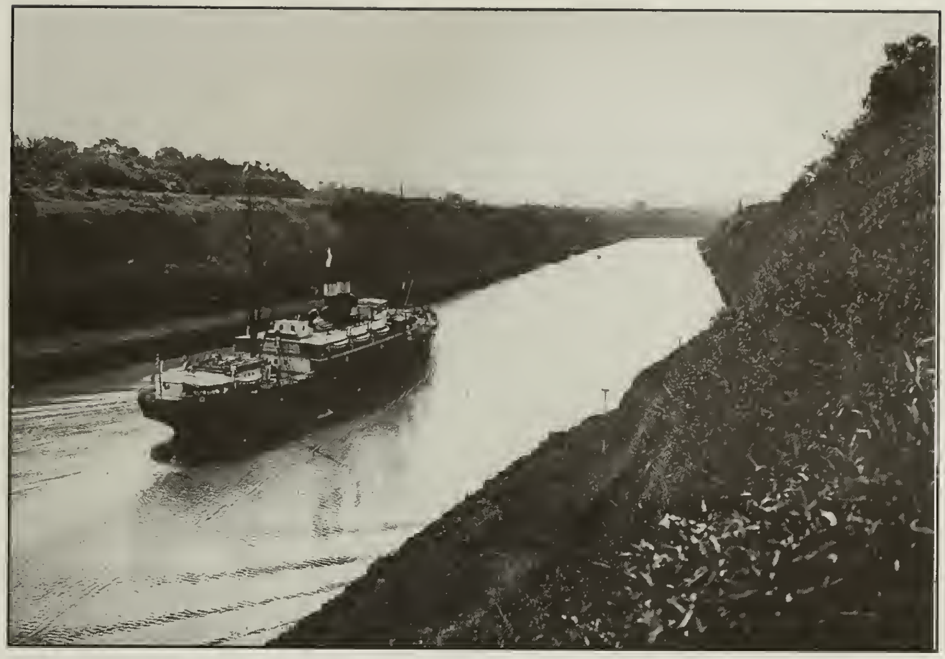
In 1907 Goethals was 47 years old and had almost 30 years experience as an officer in the Corps of Engineers. Upon graduation from West Point in 1880, he entered the Corps and began a career of river-and-harbor and lock-and-dam construction work on the Ohio and Tennessee Rivers, canal work at Muscle Shoals, and coast defense construction work in New England.

Promoted to Lieutenant Colonel in March 1907, Goethals took with him to Panama as members of the ICC two other Army engineers, Majors David Gaillard and William Sibert. Both were members of the West Point class of 1884. Gaillard was serving on the General Staff with Goethals and had experience in river-and-harbor work, while Sibert had a river-and-canal work background.

Goethals placed Army engineer Major Harry F. Hodges in charge of the ICC office in Washington, D.C., where he could use Corps personnel throughout the United States to help select and inspect equipment to be sent to the Canal Zone. Goethals initially organized the canal work by type, putting Gaillard in charge of excavation and dredging and assigning Sibert to lock-and-dam construction.

After several months of observation, Goethals was ready to make some changes. In late 1907, he moved the two Sosa Hill locks on the Pacific side inland to Miraflores because of the threat of naval bombardment. He brought Hodges to Panama as assistant engineer in charge of lock design and replaced him in Washington with Army engineer Major Frank C. Boggs. He widened the bottom width of the Culebra Cut, a channel through the Culebra Mountain in the Continental Divide, from 200 to 300 feet; and, on the recommendation of the Navy, increased the lock widths from 100 to 110 feet.

Goethals reorganized construction responsibility on a geographic basis. Major Sibert got the Atlantic Division from the ocean through the Gatun Locks to the Gatun Dam, and Major Gaillard got the Central Division of Gatun Lake and the Culebra Cut. Sydney Williamson, a Corps civilian engineer who had worked with Goethals in Tennessee and New England, got the Pacific Division from the Pedro Miguel Lock through the Miraflores Locks to the ocean. Goethals divided each division into districts, with a superintendent of construction in charge, and he organized his headquarters into sections responsible for design, buildings and equipment, and survey and personnel. Similar to the Corps system, design and general planning came from the headquarters while the details were left to the divisions.



The SS Panama in Culebra Cut, near Empire, on a trip southward through the canal.

Construction of the Gatun Dam began in 1907. The 1.5-mile earthen dam, with a concrete spillway in the middle, crossed the Chagres River to create a 164-square-mile lake as part of the canal. Lock construction began in 1909, with Army engineer Major James P. Jervey supervising masonry work of the triple locks. In 1912 Army engineer Lieutenant Frederick Mears completed relocation of the Panama railroad required by the creation of Gatun Lake. The canal was near completion in 1913, when steam shovels working from both ends of the Culebra Cut met in May and Gatun Lake began to fill in June. In September a trial lockage at the Gatun Locks resulted in the tug *Gatun* rising from the lowest chamber to the lake in 1 hour and 51 minutes. The canal would have opened in 1913 but for slides in the Culebra Cut.

Fortification of the Canal Zone was only partially completed by 1913. The Hay-Buana-Varilla Treaty gave the United States the right to fortify the zone, but it was not until 1911 that Congress appropriated the funds to begin fortification construction. With Sydney Williamson as construction supervisor and Army engineer Major Eben E. Wilson the design engineer, construction began that year on three forts on the Atlantic side and two on the Pacific. In 1912 the Chief of Engineers organized a section in his office under Goethal's son, Army engineer Lieutenant George R. Goethals, to oversee fortification construction in the Canal Zone. The first Atlantic fort was operational in 1914 and the first on the Pacific side in 1916. By the time the United States entered World War I, there were nine operational forts at each end of the canal.

With the canal ready to open, an April 1914 executive order abolished the ICC and established the Panama Canal with George W. Goethals as the first governor of the Canal Zone. Although the start of the war in Europe overshadowed it, the canal officially opened on 15 August when the liner *Ancon* passed from the Atlantic to the Pacific side. While most of the Army engineers who had worked on the canal were there in 1914, one was missing. Lieutenant Colonel David DuBose Gaillard left Panama in 1913 to seek medical attention in the United States. He died in Baltimore on 5 December 1913 of a brain tumor, and in April 1915 President Woodrow Wilson renamed Culebra Cut as Gaillard Cut in his honor.

There were rewards and honors for all for completing the canal, highlighted by the March 1915 promotions of George W. Goethals and Harry F. Hodges to major general and William Sibert to brigadier general. However, for the Army engineers, the greatest reward over the years proved to be not only that they had completed construction of the canal but that they had built a canal for the centuries. At the end of the 20th century, the Panama Canal was still operating as a vital link in world commerce.

Dr. Dunn is a historian in the Office of History, U.S. Army Corps of Engineers, Alexandria, Virginia.

Suggested Reading

Gerstle Mack, *The Land Divided;* David McCullough, *The Path Between the Seas.*

PERSCOM Notes

By Sergeant Major Theressa Fillmore

When Can I Retire?

There are several misconceptions in the field about the ability to retire, at will, when first eligible (20 years). Many senior noncommissioned officers believe, and understandably so, that once they reach 19 years of active service, they should have no problem getting a retirement request approved.

According to Army Regulation 635-200, *Enlisted Personnel*, paragraph 12-4, "a soldier of the Regular Army who has completed 20 but less than 30 years of Active Federal Service (AFS) may, at the discretion of the Secretary of the Army, be retired at his or her request. The soldier must have completed all required service obligations at the time of the retirement."

Of course, the Secretary of the Army doesn't personally approve the request. The approval authority for voluntary retirement requests is delegated to other individuals referred to as a "retirement approval authority."

Sergeants first class and above have mandatory retirement dates (MRD) that extend past 20 years. For sergeants first class, the MRD is 22 years; for master sergeants/first sergeants, the MRD is 26 years; and for sergeants major/command sergeants major, the MRD is 30 years. Any request for retirement earlier than shown is a voluntary request and may be disapproved.

The key phrase is "must have completed all required obligations at the time of retirement." The following obligations usually require an exception to policy for approval. These requests also are more likely to be disapproved.

Tour Completion. Soldiers stationed overseas are obligated to complete their tours as follows:

- Soldiers accompanied by dependents who traveled at government expense must complete the prescribed "with dependent" tour or at least 12 months from the date of arrival of dependents, whichever is longer.
- Unaccompanied soldiers must complete the prescribed "all others" tour.
- Soldiers who have no dependents must complete the tour prescribed for the country in which they are serving.

Soldiers who have requested and been granted an in-place consecutive overseas tour (IPCOT) or a consecutive overseas tour (COT) would find a retirement approval especially difficult if they have taken advantage of the benefits (family travel/leave) of the IPCOT or COT. These requests are also particularly difficult to approve because the soldier requesting the retirement causes an unprogrammed loss that usually requires a replacement in a short amount of time.

Schools. Many schools require a time-in-service obligation upon graduation. The Army expends funds training soldiers in a particular military occupational specialty (MOS) or skill and expects them to fulfill their commitment by serving in that MOS or skill for a specific amount of time. Unexpected requests for retirement would result in the Army trying to get another soldier trained earlier than expected in order to carry on the mission.

Time in Grade. Soldiers promoted to sergeant first class, master sergeant, and sergeant major incur a two-year service obligation. This obligation is from the effective date of the promotion before voluntary nondisability retirement, unless soldiers are eligible for retirement by completing 30 or more years AFS; already eligible through prior service for a higher grade at time of retirement; age 55 or older; or exercises expiration of term of service. A promoted soldier may not, at his or her request, be reduced to terminate the required service obligation.

Permanent Change of Station (PCS). Soldiers who are moved from CONUS-to-CONUS or OCONUS-to-CONUS locations are required to serve 12 months from the time of arrival. Again, the Army expends funds to move them, and in many cases their families, and expects them to serve the allotted time.

Retirement in Lieu of PCS. This is our biggest challenge regarding voluntary retirement requests. Soldiers who receive notification for PCS may request retirement in lieu of PCS subject to the following conditions:

- Soldiers who have 19 years 6 months or more of AFS when notified of PCS. The retirement application must be submitted within 30 days of receiving PCS notification. The retirement date will not be later than 6 months from the date of notification or the first day of the month following the month in which 20 years of AFS is completed, whichever is later. All service obligations must be fulfilled no later than the approved retirement date.
- Soldiers who would have less than 20 years of AFS upon arrival at a new assignment may sign a Declination of Continued Service Statement (DCSS). They are required to retire immediately upon attaining retirement eligibility, and the DCSS must be submitted and approved within 30 days of receiving official PCS notification.

As you can see, there are several roadblocks in the path of voluntary retirement. The needs of the Army usually prevail. Soldiers should not make concrete plans, such as civilian employment or school enrollment, until their retirement has been approved. Transition leave and permissive temporary duty impacts, because those dates are considered in all exception-to-policy requests. We are willing to work with soldiers and their families; however, the Army expects soldiers to fulfill their commitments to the best of their abilities.

Sergeant Major Fillmore is sergeant major of the Engineer Branch.

Lead the Way

Command Sergeant Major Arthur Laughlin
U.S. Army Engineer School

Our regiment is moving at a very fast pace, particularly in the past few months. Let me bring you up to date on the actions, tell you about some of the strong leaders I have visited in parts of our engineer training base and, most importantly, encourage you, our NCO leadership, to keep our engineers safe during this incredible time.

First, the Army is intensely planning and organizing to transform into a strategically deployable force. **Step one** is to stand up an Initial Brigade Combat Team (IBCT) at Fort Lewis this spring. This unit includes an organic engineer company. The Engineer School is literally running into the future, designing the company that supports this brigade. The school's current efforts are to design the company's organization; assist the Army in picking a squad vehicle for the brigade and its engineers; write the doctrine manuals that give the company tactics, techniques, and procedures (TTPs) that are consistent with the TTPs for the maneuver elements; and write the training plans that initially train the unit and later sustain that training. **Step two** is to stand up more brigades, each more mature in capability and deployability than the IBCT. **Step three** is to plan the transformation of the rest of the Army. Every change has a price, and the Army is making trade-offs with some new equipment to finance this transformation. The Grizzly and Wolverine programs have been identified by the Army for termination as part of the price. We at the Engineer School are working to help the Army mitigate the mission risks caused by not putting these highly capable machines into the engineer force. I want each of you to understand that the Army has made its vision clear and that each of us will assist in this transformation. I charge each leader to understand this vision (found at *http://www.army.mil*) and to explain it down to the most junior enlisted member. This is an exciting prospect and is the way of our regiment and the future of our Army.

Second, there are some parts of our regiment and the regiment's training base that are not well known. I visited several of these places and saw how our engineer leaders make a difference every day. Sheppard Air Force Base in Texas is one of those places. CPT Manus and 1SG Lea are our command team for the 51K plumbing course. Did you know that our plumbers and the Navy's Seabee plumbers are being trained by the Air Force? If not, then let me introduce you to the Interservice Training Review Organization (ITRO). For several years, we have successfully consolidated training at the Navy's Gulfport, Mississippi, base; Panama City, Florida, base; Sheppard and Goodfellow Air Force Bases; and here at Fort Leonard Wood. At each site, we have engineer leaders like Lea and Manus who have learned new ways of doing business and met the training and certification standards of the host unit. So when you are deployed and get assistance from engineers of a sister service, you know they all came from a common training heritage.

I'd like to highlight one of the gems of this ITRO training at Panama City. Under the leadership of a super command team, CPT Perusek and SFC Kane, highly motivated and highly qualified soldiers learn to be Army MOS OOB divers. These divers are trained on scuba techniques and surface-supplied (or hard-hat) diving and upon graduation are awarded the rank of second class diver. Great soldiers like SSGs Thompson and Haney challenge our divers to be the very best. Anyone interested in becoming an Army diver should check website *http://www.wood.army.mil/TDD/mos00B.htm* for information.

I have found some key fundamentals at these sites that make the difference between mediocre and excellent soldiers. I see NCOs who are willing to learn new ways of doing business while maintaining the standards of our Army. The old adage of "the only right way is the Army's way" no longer holds true. I see NCOs communicating effectively with superiors, regardless of service, and being effective in dynamic environments. Finally, I see NCOs demonstrating the professionalism of Army NCOs to our sister services. The NCOs' dedication to duty and straightforward honesty and love of country quickly convince the Air Force, Navy, and Marine Corps that we are all on the same team—America's team.

Third, and most dear to me, is safety. In my last article, I told you that safety and enforcing safety standards are leaders' business. That hasn't changed – and it won't. The last calendar year is one I do not wish to see us repeat. In spite of all our efforts, we lost too many soldiers. We must do better. I again challenge every leader to relook their risk-assessment procedures. I challenge them to demand that safety standards be enforced at every level. You must be vigilant in enforcing those same standards. Risk assessment is a continuous and deliberate process. If your training conditions are less than adequate or have changed at any time since your risk assessment, RE-EVALUATE ASAP. I must tell you that it is not the war-fighting skills or those high-risk tasks that we give our full attention to that cause us anguish. More often it is day-to-day duties, such as driving back and forth to the unit or driving down the road in an M113, that give us grief. Simple things—wearing a seat belt, ensuring that jack stands are properly positioned, and chocking your vehicle when it is parked—will prevent tragedies. As NCOs we teach our subordinates to meet the standards, and we always set the example ourselves. In doing this, we survive the hazards of day-to-day life as well as the battlefield. Our profession is dangerous by its inherent characteristics. Weapons, fatigue, exposure, heavy equipment, inexperienced personnel, and combat are what we accept with our choice to serve. We think carefully about what we will do, identify each hazard, and figure out how to get around those hazards. For weapons we use range procedures and ammo discipline; for fatigue and exposure we use leader checks and proper equipment. When we stop using this smart approach, we get into trouble. Motor pool safety procedures that become routine become deadly. Off-duty travel when we are tired becomes a tragedy. Leadership can keep our troops safe.

These three things are my messages to you. The Army is moving out, and we engineers are going to move out too. The regiment is training hard with our sister services, and NCO attributes are making that successful. Finally, safety is a prime area for NCO leadership to make a big difference.

Two special opportunities are coming for us to further discuss the critical NCO leadership tasks. First is ENFORCE 2000, when we gather all the command leadership teams in our regiment here at your engineer home. Second is the Regimental Sergeants Major Conference this fall in Savannah, Georgia. Please contact me at *Laughlia@wood.army.mil* with any issues you think need to be discussed.

Remember to be safe, train smart, and train to standard. Never forget that each one of you is an important combat multiplier.

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April 2000

One Regiment

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CLEAR THE WAY

By Major General Robert B. Flowers
Commandant, U.S. Army Engineer School

To tell you that the Army and the Regiment will face unique challenges and exciting changes ahead would be an understatement. You know as well as I that the CSA's Transformation Strategy, although desperately needed to align Army capabilities with known threats through 2010, requires major paradigm shifts as well as tough resourcing decisions.

Central to ensuring that the Army can achieve the desired end state for the "Initial Force" (present to 2003) were some extremely agonizing resourcing decisions that resulted in the Presidential Budget Decision 745 termination of the Grizzly and Wolverine programs. Since announcing the decision, we have secured the backing and public support of key MACOM commanders, CINCs, and senior Army leaders in the Pentagon. We now very much expect that Congress will reverse the decision this summer.

With this understood, I assure you that your Engineer School has been feverishly working to position the Grizzly and Wolverine program for success. Our strategy has already begun to reap some benefits. We were able to secure sufficient FY00 funding to procure 14 Wolverines—enough to field an entire battalion set later this year at Fort Hood. We also feel that we have positioned ourselves to restart the program with minimal effort by gaining support for placing the Grizzly and Wolverine on the Army's 1-N list of essential unfinanced programs. In fact, both are in the top 20 and stand a great chance for restarting whenever Congress allows. We expect the first decision point on restarting by 4th quarter FY00.

Additionally, we have begun efforts to evaluate alternatives in case the Grizzly and Wolverine are not allowed to restart. Recognizing that none will fully replace the phenomenal capabilities of either the Grizzly or Wolverine, our initiatives include—

- Restoring personnel and equipment—specifically 57 sappers, 9 ACEs, and an M113—to the Force XXI Heavy Engineer Battalion force structure.
- Restarting the MICLIC replacement program, specifically the Explosive Standoff Minefield Breacher (ESMB), to provide standoff capability against all surface and buried minefields effective against all known threats through 2010.
- Reviewing best alternatives to upgrade the AVLB by improving its hydraulics and electrical systems, adding a new suspension, replacing the power train, and upgrading it to MLC 70 bridge capability if we fail in our efforts to restore the Wolverine.
- Improving the ACE by increasing its dozing, armor-protection, and communication capabilities, as well as improving its maintenance and sustainability.
- Modernizing the Engineer Squad Vehicle to a Bradley for greater survivability through lethality and commonalty with the Brigade Combat Team.
- Continuing to demonstrate the requirement for an Engineer Brigade headquarters in the force structure of the Force XXI Heavy Division.

The Grizzly and Wolverine situation, as well as numerous other issues affecting the regiment, will be discussed during our upcoming Engineer Force (ENFORCE) 2000 Conference. The USACE DPW Training Workshop will meet 1-3 May. MACOM engineers will meet 2 May. We will all gather together as *One Regiment* for the remainder of the ENFORCE 2000 Conference 3-5 May. The ENFORCE 2000 Golf Tournament is scheduled for 6 May.

The ENFORCE 2000 Conference theme is "Engineers Shaping the New Millennium." A key undercurrent of this year's conference is the remembrance of the 50th anniversary of the Korean War. I will deliver the commandant's "State of the Branch" presentation—a candid update of our branch. Lieutenant General Joe N. Ballard, our Chief of Engineers, will conclude the formal agenda with a "State of the Regiment" presentation. The conference finale will be the 12th Annual Engineer Regimental Dinner, during which the Itschner, Grizzly, and Sturgis Awards and the Gold de Fleury Medal will be presented.

This year's conference administrative information and registration are available via the Internet on the Fort Leonard Wood home page. Spouses are invited to join the Regimental Dinner and other conference social activities. Information outlining activities available for spouses during their stay can also be found on the Fort Leonard Wood home page.

It is imperative that we continue speaking with one voice as *One Corps, One Regiment, One Team*. Your input and active participation are critical to guide and strengthen our actions. I look forward to seeing you at Fort Leonard Wood. Be sure to study for the test!

Essayons!

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Front Cover: *"One Regiment"—Active, Reserve, National Guard, and Corps of Engineers work to revolutionize the way the Army provides support.*

Back Cover*. Soldiers of the 8th Engineer Battalion, 1st Cavalry Division, put logs under the weakened support of a bridge near Yangzi, Korea, to prevent its collapse until a tank retriever can arrive and remove the M-4 tank. (28 Jan 51)*

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DEPARTMENTS

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TRANSFORMING THE ENGINEER REGIMENT

By Lieutenant General Joe N. Ballard

Charles Darwin once said, *"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."* This quote is very appropriate, given the changes occurring in the Army. General Shinseki realized that the Army had to change, to transform itself to meet the needs of the current global environment. The Army's vision is to produce a more deployable force that is lethal and survivable. As the Army changes, so will the Engineer Regiment. We can either swim with the current of change and make it across the river or swim against the current and drown.

For the Engineer Regiment to properly support the new, more mobile Army, we will have to revolutionize the way we provide support. This metamorphosis will be even more difficult if we are not unified.

The Army transformation has posed several challenges to the Engineer Regiment. First, two of our procurement programs—the Wolverine and the Grizzly—have been put on the shelf. Second, the new Initial Brigade will have only one organic engineer company. And third, the force structure for engineer units that are echelons above division and corps will probably be reduced.

These changes require our regiment to do some innovative thinking to determine how we will provide world-class engineer support to this more deployable Army. What we need to do as a regiment is get on board with the transformation and decide how the regiment can best support the new Army vision.

I challenge you to consider how we can optimize our performance, given the structure already determined for the Initial Brigade Combat Teams. We don't have all the answers because the transformation is still in its early stages. But in this article, I'd like to share some of my thoughts on recent events and where I think the regiment needs to go.

Initial Brigades

As has been well publicized, the new Initial Brigade calls for only one engineer company to be organic to it. We have become accustomed to a brigade having a full battalion of engineers. The transformation is a fact of life, and it is unlikely that the Initial Brigade structure will change significantly with regard to its organic engineers. This company will have many of the capabilities that are already found in a mechanized engineer company. The challenge is to accomplish all the mobility, countermobility, and survivability tasks for the Initial Brigade that an engineer battalion provides now.

The Engineer School and TRADOC are working to determine how this engineer company will fight and how it will be augmented during contingencies. There are still a lot of problems to be resolved. Probably the most important thing that we can do as a regiment is to influence the force structure at the division level.

We are continuing to work to keep the engineer brigade structure. This command element is essential in order to coordinate augmenting engineer forces. We are also working to ensure that there are augmenting engineers available at the division level. Our challenge will be to justify to the Army what the right engineer mix is to support the force. To do that, we have to develop sound reasons for retaining force structure.

The Army transition strategy has raised the question, "How do we provide the best engineer services to the Army and DoD?" The regiment's place in the new Army will be determined by how well we answer that question.

We must use our collective experience and knowledge to define practical, workable solutions to these problems. We will know more as the new brigades begin to train and test their new force structure. I challenge everyone in the regiment to stay engaged. The results of these brigades' training exercises will affect every engineer's future.

Wolverine and Grizzly

As I mentioned earlier, we have lost funding for the Wolverine and Grizzly. It looks as if one battalion's worth of equipment will be fielded in the case of the Wolverine. The Grizzly program will be stopped and positioned so that it can be restarted if funds become available. These systems are at the top of the Army's list of unfunded priorities. We need to keep pushing for them.

It is a fact that there is a lack of capability inside our current structure to conduct gap crossings and breachings. The transformed Army will be a full-spectrum force. These systems are needed to support a high- to medium-intensity conflict. Engineer School personnel are analyzing other equipment that is more deployable. These newer systems will be the first to the battlefield. But the larger, more survivable equipment will still be required to prevent casualties and ensure mobility. Regardless of whether they are in tracked or wheeled vehicles, the maneuver forces will require mobility support, and it is our responsibility to provide that support. How will we do that, given the constraints placed upon us?

> ***"As the Army changes, so will the Engineer Regiment. We can either swim with the current of change and make it across the river or swim against the current and drown."***

Engineer Services

It is clear that the Army will soon be a lighter, more deployable force. For the Engineer Regiment to be of the greatest benefit to that force, we need to be able to bring the full capabilities of the regiment to bear on any situation. That means we must do a fundamental relook at the full spectrum of engineer support to the Army and to our Joint forces.

The old ad hoc delivery of engineer services to the multitude of contingency operations around the world simply does not meet the standard that is expected from the regiment. We must have a clearly understood, well-coordinated doctrinal process for engineer support, from minefields to theater operations. This process must better use the resources and command-and-control structure of USACE—the engineer MACOM. It must leverage the strengths of our engineer troop units—both active and reserve—while minimizing weaknesses. It must leverage the tremendous worldwide contractor resources that we can tap into. It must leverage the capabilities of Corps labs, districts, and divisions.

We have been working on several initiatives to provide this type of support. One initiative that we are currently working with the Army Staff is aimed at improved delivery of engineer services above the tactical level. This plan will better use the resources and command-and-control structure of the engineer MACOM.

USACE division commanders are aggressively engaged with every CINC now, and we will increase planning staffs to integrate with CINC operations over the rest of this year. We are working as a part of the Army Transformation Team to dramatically improve how the regiment provides engineer services to U.S. forces.

The engineer support to Kosovo is a good example of how engineer services can optimize the effectiveness of the force. USACE's North Atlantic Division was directly engaged with EUCOM to deliver the required engineer services above the tactical level. By using the full spectrum of engineer capabilities available, we were able to get U.S. forces into winterized billets within 90 days (see article on page 6).

During this mission, we reached back to the USACE labs and district personnel to acquire technical assistance as well as contractor support. It was truly a coordinated effort between every aspect of the regiment. And it worked!

USACE has structured itself to be theater-focused. A general officer from one of our major subordinate commands is focused on each theater. Each CINC headquarters will soon have a USACE planning cell. This is a natural extension of the work USACE is doing around the world. The added planning resources will strengthen USACE ties and reinforce the existing ENCOM planning link for major theater war scenarios. Also, the USACE planning cell will fill the gap in engineering planning that exists for contingency operations such as the flooding in Mozambique.

The goals are to build on the current interaction between each CINC's staff and USACE and to take advantage of current engineer theater engagement under programs such as foreign military sales and nation-assistance projects. The result will be better engineer support to all CINCs across the full operational spectrum.

The Future

The future of the Army is to be a more deployable force. For engineers to be of full benefit in that force, we need to be innovative and develop a force that is agile and synchronized across the battlefield and the full spectrum of conflict. Each component of the regiment must work together as a focused team. We must make the term *One Regiment* a reality. We can continue to provide a full spectrum of engineer services to the Army with a lighter, more deployable force. To do this, we must have seamless integration of all aspects of the regiment. Our goal is to maximize engineer support with the smallest footprint possible.

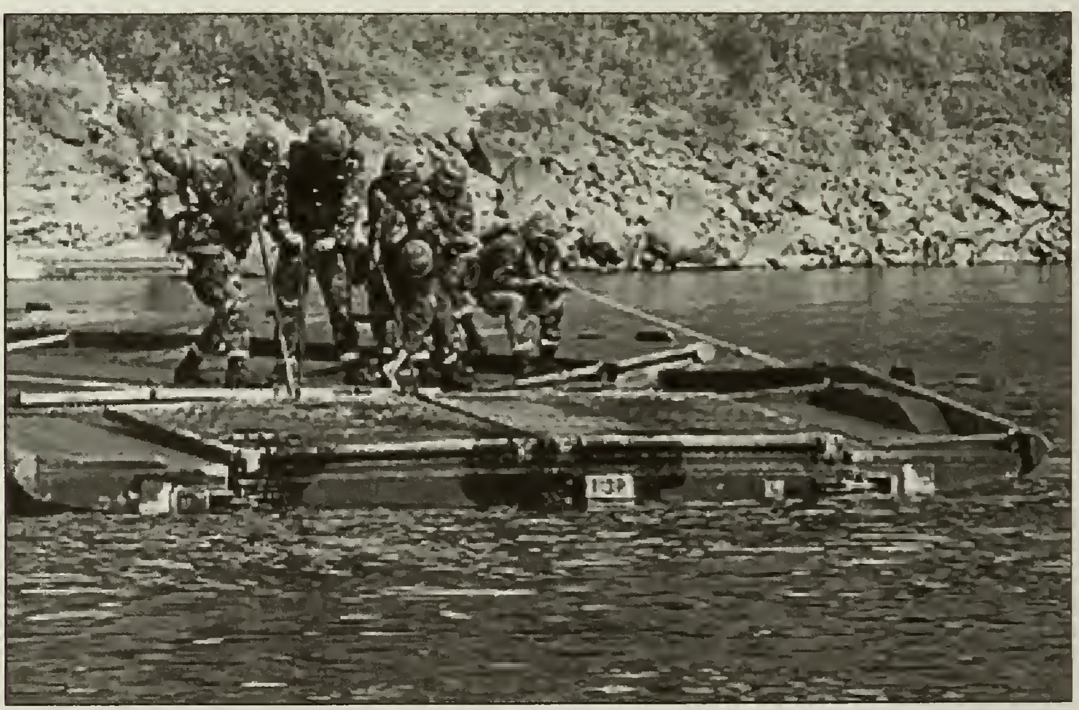
All the changes and initiatives I just mentioned are the close fight. These are actions that we are currently working and, by the time this article is published, may already be determined. However, as a regiment, we need to focus on the deep fight. After the structure of the engineer forces is determined, how will we operate? Can we predict the challenges and shortcomings of the new structure before they become crises? Some of this will shake out as the new brigades start to train. But the integration of these brigades with division and echelon-above-division engineers will take the collective energies of the entire regiment to determine the best support ratios and operating techniques.

Last year, I published an article in this magazine challenging the regiment to focus on working as a unified organization. At a recent Senior Reserve Engineer Conference, the commanders briefed some of their efforts to help form a more unified team. We have made some progress, but we still have a long way to go.

The transformation of the Engineer Regiment cannot be accomplished by a small group of officers in the Pentagon or the Engineer School. It takes the collective input of every component of the regiment to ensure that we capture the ideas we can use to make our new structure a success. We must learn to communicate with one another.

Recently MG Halvorsen, commander of the Texas National Guard's 49th Armored Division, took charge of the U.S. forces in Bosnia. This is the first time the active-duty soldiers in Bosnia have come under the control of a commander from the National Guard. This is not an isolated incident—this is the future. For engineers, this is even more significant because under the new Army structure, active-duty soldiers will find themselves working much more often with reserve and National Guard engineers. To provide seamless support, we must be able to operate together. That is why communication, cooperation, and information sharing is so critical.

The Army is changing, and the Engineer Regiment is going to change with it—there is no doubt about that. There is a lot we can wring our hands about, but hand-wringing isn't going to help matters. Now is the time for leadership, and for the entire regiment, to pull together. No one is well-served if the regiment is piece-mealed by equipment cuts here and personnel cuts there. We cannot afford to play catch-up as the transformation plan for the Army



(DoD photo by TSgt James Mossman, USAF)

Soldiers from the 50th Engineer Company, 1st Platoon, and the 2d Battalion, 9th Infantry, pull together two sections of pontoon bridge on the Imjin River in the Republic of Korea. They are participating in the exercise as part of the U.S. Army Officer Professional Development Program.

(DoD photo by SSgt Lisa Zunzanyika-Carpenter, USAF)

Army engineers from A Company, 40th Engineer Battalion, and A Company, 20th Engineer Battalion, push a partially constructed Mabey and Johnson bridge into position at Camp Demi, near Kladanj, Bosnia-Herzegovina.

vision is executed. We must get out ahead now with a solid engineer support plan. We all must be engaged in this planning for engineer support to the Army and the nation. It is up to us to ensure that these changes do not jeopardize the safety of our soldiers or the defense of our country.

Challenges to the Regiment

These are my challenges to the members of the Engineer Regiment:

- Be a student of change. Pay attention to the results of the testing of the new structures and equipment.
- Be knowledgeable of how engineers are integrating into the Army vision.
- Talk to the forces you support about their requirements and engineering changes. Ensure that their ideas and concerns are relayed through the engineer chain of command to the decision makers.
- Be an active part of the dialogue at your level. Make sure your soldiers and junior leaders know what is happening. It will affect their future.
- Talk to people at the Engineer School. They are the proponents for these changes, and they need information concerning issues in the field.

During my more than 35 years in the Army, I have never seen the Engineer Regiment presented with the magnitude of changes that are happening as we speak. Meeting the challenges that the Army transformation provides is an opportunity for us to become more efficient; to be a stronger, more unified team; and to revolutionize our support to the Army. We must rise to the challenge.

In conclusion, I would like to share with you the words of President Dwight D. Eisenhower, who said, *"Engineers build for the future, not merely for the needs of men but for their dreams as well. Thus, inherently, the engineer's work is a fearless optimism that life will go forward and that the future is worth working for."*

I challenge all of you to go out and work to keep the regiment ready to meet the needs of the Army.

Essayons!

Lieutenant General Ballard is Chief of Engineers and Commander of the U.S. Army Corps of Engineers. He previously served as Chief of Staff of the U.S. Army Training and Doctrine Command, Fort Monroe, Virginia. LTG Ballard is a registered professional engineer in civil engineering.

The Engineer Regiment in Kosovo

By Colonel Robert L. McClure

For the better part of 1999, much of the world's attention was focused on Serbian President Slobodan Milosovec's ethnic atrocities in Kosovo as well as NATO's 78-day bombing campaign that eventually compelled Milosovec to stop and accept deployment of an international peacekeeping force in that beleaguered province. American soldiers first entered Kosovo on 12 June as part of that force and began to establish a safe and secure environment. The media gradually began to pull out of Kosovo, so by the end of the year, Kosovo, along with Bosnia, became essentially "backwaters" of international interest. The Russian war in Grozny, the new millennium celebrations, and other issues commanded headlines.

For engineers, that was a bit of a shame because what happened in Kosovo after June is just short of a miracle: two base-camp "cities" were erected in record time to house the American force and its allies before the onset of a harsh Balkan winter. For me personally, Kosovo after June 1999 was an engineer's dream. While perhaps not news to the rest of the world, in Kosovo the Engineer Regiment again proved its versatility and worth to the Army and, more importantly, to our soldiers.

Planning

Engineer planning for operations in Kosovo began months before the first bomb was dropped. At the outset, planners wanted to use the lessons learned in Bosnia and convinced decision makers to reach base-camp "end state" as quickly as possible. Because of uncertainty about the Bosnian mission's duration, when the Army moved across the Sava River into Bosnia in 1995, soldiers were housed first in tents – in the winter! Only years later were they moved to semipermanent Southeast Asia (SEA) huts (a theater-of-operations design that first made its debut in Vietnam) on base camps. Engineer planners knew it was much more cost effective to forego this gradual approach in Kosovo in favor of building end-state SEA huts right away, and operational commanders agreed with this approach.

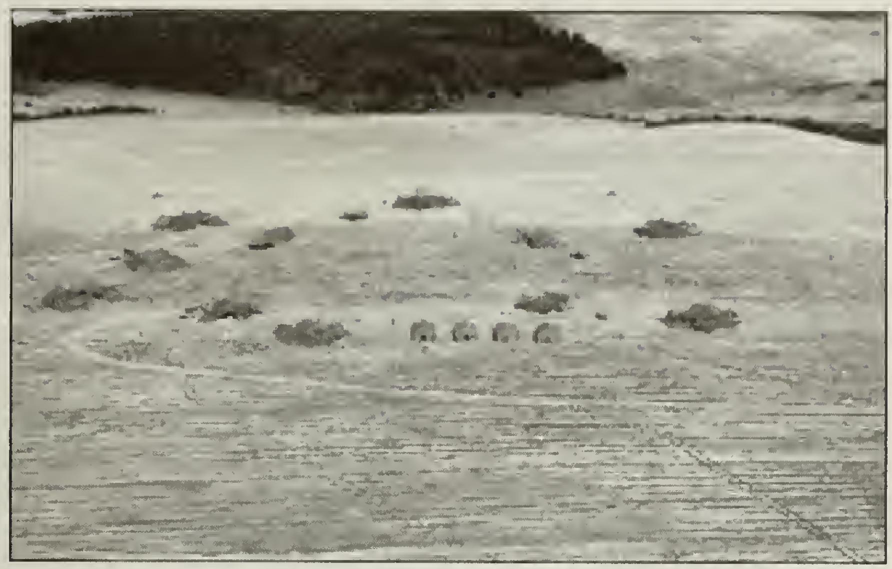
The First Infantry Division (1ID), known as the "Big Red One," was tapped to be the first unit in Kosovo. The division's Engineer Brigade would

A view of Camp Bondsteel

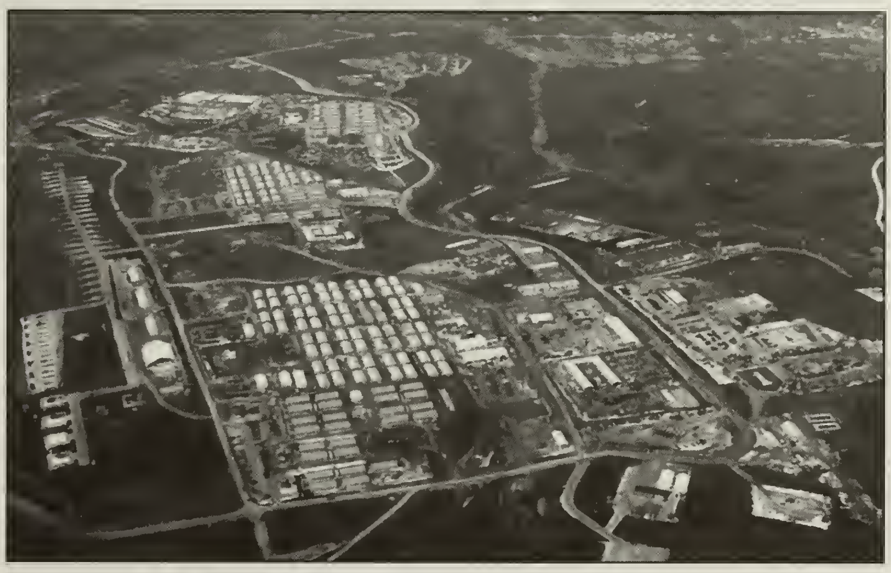
oversee the sapper and construction-engineer effort. A relatively new entity (engineer brigades within divisions were formed less than 10 years ago), the organization would prove its worth by integrating engineers from outside the division, indeed around the world, into the task-force effort. The Engineer Brigade commander at the time, COL Joseph Schroedel, and his staff worked tirelessly at a base-camp plan that would incorporate all the necessary requirements and still be functional for the mission. Incorporating requirements from force-protection experts and safety specialists, Engineer Brigade personnel laid out a base-camp "template" that depicted where soldier living areas should be arranged in relation to helicopter flight lines, ammunition holding areas, etc. At the same time, planners also took geologic data (obtained from the Waterways Experiment Station in Vicksburg, Mississippi) that indicated possible underground water sources and matched the data to possible camp locations that had been selected from satellite imagery.

The engineer force assembled in Kosovo in the summer of 1999 consisted of more than 1,700 personnel under the command and control of 1ID's Engineer Brigade. Foremost was the organic 9th Engineer Battalion, whose mission was to provide direct support to 1ID's 2d Brigade Combat Team. Attached construction units included the 94th Engineer Combat Battalion (Heavy), with the 535th Combat Support Equipment Company from Germany; Naval Mobile Construction Battalion 3 (Seabees) from California; A Company, 864th Engineer Battalion from Fort Lewis, Washington; and the 568th Combat Support Equipment Company from Fort Riley, Kansas.

Also attached to the 1ID Engineer Brigade were explosive-ordnance-disposal units and a team of about 30 military and civilian engineers from the U.S. Army Corps of Engineers Baltimore District with expertise ranging from structural to electrical to environmental engineering and more. The team's job was to integrate the final requirements of units and agencies on the camp, assist with final design, and ensure that standards were being met by both contractor and construction engineers. This team came with its own video teleconference system back to districts in the states and made the term "tele-engineering" come alive. More than once, the answers to tough engineering questions were no more than a telephone call away. A construction-management section attached to the brigade staff assisted the construction battalions with design and layout of various projects. The brigade staffed a mine-action center in the task-force headquarters that maintained a database of all known and suspected mine locations in sector and also coordinated United Nations and humanitarian demining operations.



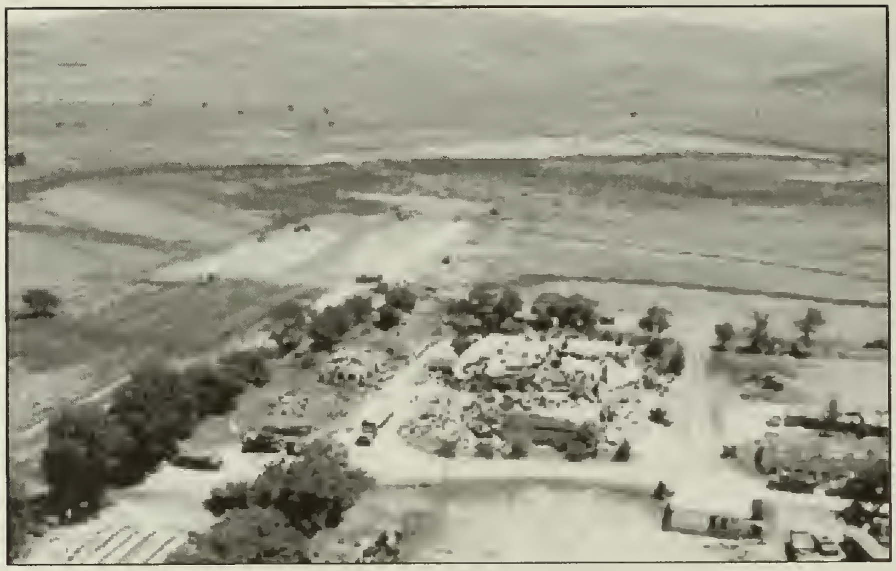
Camp Bondsteel, 15 June 1999



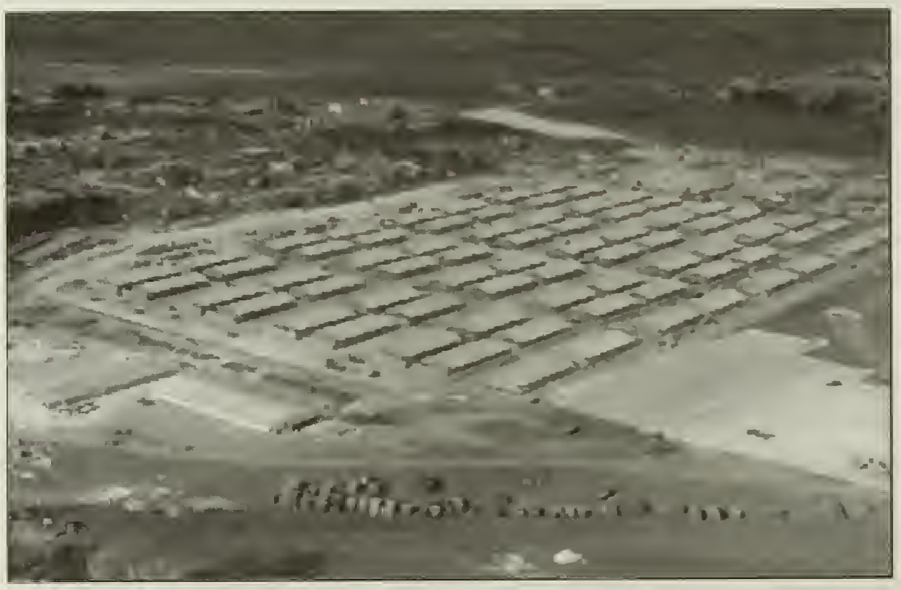
Camp Bondsteel, 15 October 1999

Mission

The mission was simple, daunting, and as broad as any the Corps of Engineers had ever faced. First and foremost, it was to provide direct engineer support to the maneuver commander with mobility and force protection so that a safe and secure environment could be established in



Camp Monteith, 1 July 1999



Camp Monteith, 15 October 1999

sector. This would not be easy and proved to be a challenge to the 9th Engineer Battalion every day until it left the theater. At the same time, the Engineer Brigade was to merge construction assets and integrate them with the contractor, Brown & Root Services Corporation, to build not one but two base camps for a total of 7,000 troops. That would have been a tall order in itself had not the V Corps commander added a deadline of 1 October. His challenge to the engineers was to ensure that housing for soldiers was built before winter set in, and he didn't care that the deadline happened to be less than 90 days after many of the construction units arrived on site.

During this time, two phrases were adopted as unofficial mottos to help leaders at all levels discern the highest priority when conflicts arose and to remind everyone that there were more engineer missions than there were engineers. Those phrases were "It's the SEA huts, stupid!" and "No idle engineers!"

When the 9th Engineer Battalion hit the ground in Kosovo, it began building triple-standard concertina fences around the areas selected for the two base camps—Bondsteel and Monteith. In all, elements of the 9th built more than 17 kilometers of fence in Kosovo, 10 kilometers around the perimeter of Camp Bondsteel alone. Additionally, the battalion reconnoitered more than 320 kilometers of roads and classified 75 bridges for military use by sappers. Because of the magnitude of the overall peacekeeping mission, one company from the 9th was reorganized as infantry and attached to a mechanized infantry battalion to conduct presence patrols near the city of Gnjilane (see *Engineer*, February 2000, page 6). Other missions for the 9th included clearing mines and ordnance when they impeded maneuver and constructing force-protection bunkers on base camps to protect against possible indirect fire.

The construction effort began in earnest around the first of July with the arrival of the Seabee battalion overland from Albania, where the battalion had been a part of Task Force Hawk during the air war. The Seabees occupied Camp Monteith (on the edge of Gnjilane), which had been a Yugoslav army artillery barracks before the war. The camp itself was largely untouched, except where two precision bombs had destroyed the maintenance facilities. However, either retreating forces or locals had trashed and looted each building, and it took weeks to make them usable again.

Force-protection concerns caused by the closeness of Gnjilane forced us to abandon many of the original buildings on Camp Monteith and build most of the camp in an adjoining field. More than 75 SEA huts, along with support structures, were built for the planned force of about 2,000. It is perhaps a curse of fate that those looking for engineer stories in Kosovo always will overlook Camp Monteith. But even though it is smaller than Camp Bondsteel, Camp Monteith—the site of the American headquarters—is no less an engineering marvel. Buildings have been refurbished, electricity and water run to all soldiers' quarters, and facilities such as weight-lifting and recreation rooms have been built in large fest tents. The

Soldiers from the 9th Engineer Battalion set up concertina wire around the construction area at Camp Bondsteel.

camp is also the center of tactical activity in the American sector because of the mixed ethnicity of the surrounding population and the camp's proximity to the Russian battalion serving alongside other peacekeepers in Kosovo. Indeed, the first American fire support for Russian forces since World War II—155-millimeter illumination rounds—were fired from the artillery positions made by Seabee engineers at Camp Monteith.

But Camp Bondsteel is the "Grande Dame" in Kosovo of what engineers do. Spread over almost 900 acres of rolling wheat fields, it was picked early on to become what it is today—the major American base camp in theater. Within its fenced perimeter are more than 175 SEA huts, a 30,000-square-foot headquarters building, an ammunition holding area, motor pools, chapels, recreation and dining facilities for about 5,000 American and allied soldiers, and a helicopter airport with more than 50 parking pads. Water is piped into each hut from huge holding bags filled by several wells in camp. And there's even a wastewater treatment plant. It is Camp Bondsteel that benefited most from all the staff planning conducted early on. Its layout is very similar to the templated camp design, adjusted only for the terrain and other factors.

The numbers involved in building both camps were staggering. At the height of the effort, about 1,000 expatriates hired by Brown & Root, along with more than 7,000 Albanian local nationals, joined the 1,700 military engineers. From early July and into October, construction at both camps continued 24 hours a day, 7 days a week, with perhaps half a day each week for soldiers to perform personal chores and equipment maintenance. More than a quarter-million 2 by 4s were used, along with almost 200 tons of nails and more than 100 miles of electrical cable. More than a half-million cubic yards of earth were moved on Bondsteel alone, and the gravel used at both camps would cover a two-lane road from St. Louis to Kansas City.

Camp construction centered around the SEA huts. Each living-area bay was 16 by 32 feet—almost exactly the size of the familiar medium, general-purpose tent. In Kosovo, we joined five of these bays and a latrine under one roof. We planned for six soldiers per bay, 30 soldiers per SEA hut, and 120 soldiers—about a company's worth—in a "quad" of SEA huts that were then surrounded by a force-protection wall. We covered the plywood floors with linoleum and hung plasterboard on the walls for fire resistance. We installed smoke detectors, emergency lights, and eight electrical outlets in each bay. The SEA huts had vertical supports that rested on concrete footers placed on compacted earth and gravel. We used no foundations and did not place footers on fill because of settlement. We installed a heater/air conditioner and a small window at each end of the bays. We routed electricity, water, and communications utilities underground and prefabricated walls and other sections so they could be constructed quickly.

Toward the end of September, it was taking about 18 days from initial site preparation to complete a SEA hut for 30 soldiers, with dozens of them under construction at any one time. In the end, more than 700,000 cubic feet of living space had been built—equal to a subdivision of some 355 houses—all in less than 90 days!

Challenges

Obviously, any endeavor this size is not without its challenges. Shortly after site preparation began at Camp Bondsteel, a 36-inch natural-gas pipeline was discovered under the camp – right where we wanted to make a 3-foot cut! It was easier to redesign the camp around the pipeline than dig it out, and that's why today a "no-construction" strip of land runs northwest to southeast among the SEA huts. The total absence of civilian sewage-treatment facilities in Kosovo forced early diversion of critical horizontal equipment to build sewage lagoons, so we would not foul the local watersheds.

Outside the wire and at the other end of the engineers' mission spectrum, the 9th Engineer Battalion was given several ethnically mixed villages to control, because someone occasionally terrorized the area with small-arms and mortar fire at night. Although the "mad mortar man" was not caught, he did stop after a section of tanks and a military-police element were placed under control of the engineer lieutenant in Gnjilane. The combat engineers' ability to not only maintain control under extreme circumstances but also to inspire confidence in this small village and elsewhere speaks volumes of the American soldier and junior leaders who made it happen on the ground.

Lessons Learned

The engineer lessons learned in Kosovo are few and simple. First, a brigade-level command-and-control headquarters was essential to effectively integrate the enormous engineer effort required to get soldiers under cover before winter. While many have questioned the need for engineer brigades in divisions as the Army looks ahead in the twenty-first century, it was essential to Task Force Falcon's early success. The magnitude of commanding more than 1,700 soldiers and integrating the efforts of nearly 10,000 people would have swamped a normal engineer-battalion staff.

Second, our engineer soldiers are trained and led well, as evidenced by the broad range of missions they accomplished—from patrolling as infantry to major camp construction. However— and this is not news—their equipment is outdated. The 94th Engineer Battalion had some bulldozers that vendors no longer stocked parts for in theater. The only sources for parts for many of the prime movers and trailers were cannibalization points in the United States.

Finally, we need to put some muscle back into the sapper battalions. For a variety of reasons over the past several years, these battalions have been cut to the bone and are on the verge of becoming irrelevant on the battlefield. According to the table of organization and equipment, the personnel strength for line companies in sapper battalions is now less than 100. When such a unit is manned at less than 90 percent strength (as was the case in June 1999), and you subtract nondeployable soldiers (all units have them), you end up with 65-person companies patrolling sectors as infantry or trying gamely to conduct route-clearing operations that would be so much easier with more soldiers. It's time to stop doing more with less.

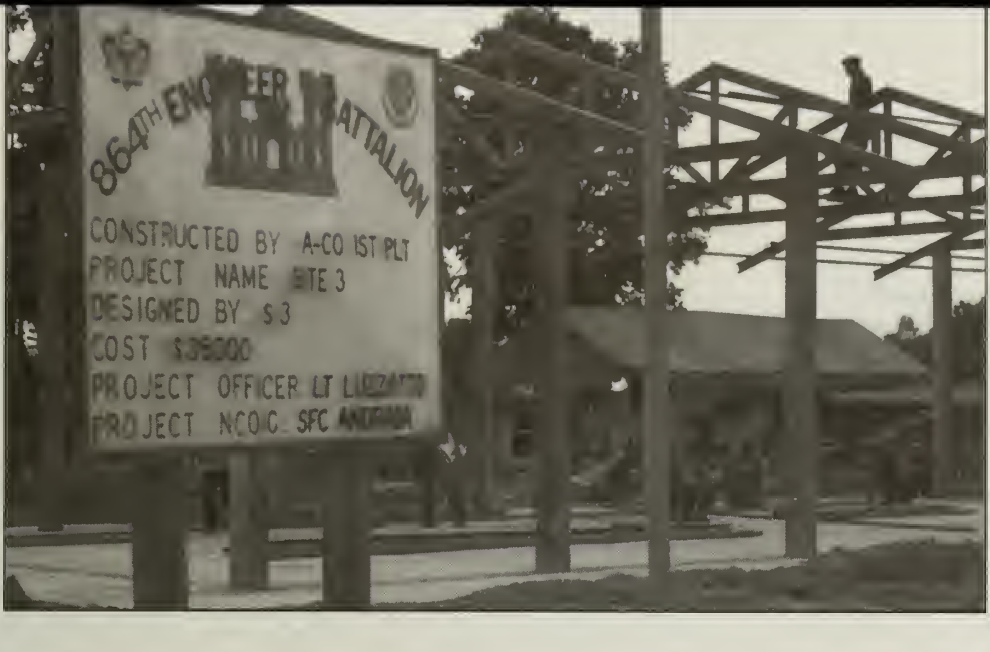
As the millennium changed, so did the engineer force in Kosovo. And, although most of the camps were built by Christmas, a significant list of projects remained. Taking over from the 9th Engineer Battalion was their sister unit, the 82d "Blue Babe" Engineer Battalion from Germany. A National Guard combat-heavy construction company from North Dakota—B Company, 142d Engineer Battalion—deployed to take over duties from the 568th and 864th Engineer Companies. Additionally, a company-sized "air detachment" of Seabees replaced Naval Mobile Construction Battalion 3 at Camp Monteith.

Accomplishments

The story of American forces in Kosovo is far from over. However, as opposed to the Army's earlier experience in Bosnia, soldiers deploying to Kosovo will have a warm, dry place to live. There, the Engineer Regiment came together as one and, in record time, built base camps worthy of American soldiers, so they could perform their critical duties. Although the camps were by and large complete when the world celebrated the new millennium, engineers were not left without a mission. Presence patrols by combat engineers continue around the clock, minefields and unexploded ordnance are still being marked, and snow from main supply routes throughout the American sector is being removed by engineers with more than a half-dozen plows and salt spreaders. Yes, engineers have been tasked to plow snow in Kosovo. It is no surprise that the clearest roads there this past winter were in the American sector.

With luck, much of the world will turn away and forget the terrible tragedy of Kosovo as time passes. However, the Engineer Regiment should not forget its accomplishments but build on them as *One Team, One Regiment, One Fight*—active and reserve, civilian and military. Anyone who has had the opportunity to see what the Engineer Regiment created in so short a time in Kosovo cannot help but be impressed with the "can-do" spirit of engineers, as well as that of America and her Army, when the mission demands action.

Colonel McClure commands the 1st Infantry Division Engineer Brigade. He was previously on the U.N. peacekeeping mission planning staff in New York; commanded the 92d Engineer Battalion when it built the U.N. base camps in Haiti; and served more than 10 years in Germany, including company command in the Berlin Brigade. COL McClure is a West Point graduate, holds a master's degree from the Kennedy School at Harvard and a War College Fellowship from the Center for Strategic and International Studies in Washington, and is a registered professional engineer in Virginia.



Cobra Gold '99

Tests the Eight-Step Training Model

By First Lieutenant Matthew Luzzatto

For several years, the eight-step training model has been a helpful guide that many units have adopted as their standard operating procedure. Closely resembling troop-leading procedures, the training model refined the existing standard into a straightforward method for conducting quality training. This past year, the 864th Engineer Combat Battalion (Heavy), Fort Lewis, Washington, put the eight-step training model to the test and proved its effectiveness during the 84th's deployment to Thailand as part of Cobra Gold ‘99.

Cobra Gold '99 joined the U.S. and Thai militaries to build four multipurpose village activity centers in less then a month. Varying slightly in design, each building rested on an 80- by 40-foot concrete pad with precast concrete columns. On top of the columns was a steel-framed roof support system with a heavy concrete tile cover. Each building consisted of some variation of block construction and might include end walls, various rooms, or decorative block with steel-mesh enclosures. Built adjacent to existing school compounds, the new activity centers furnished much-needed classrooms and functional meeting spaces to these remote and economically depressed villages. In addition, U.S. and Thai soldiers received valuable joint operations construction experience.

With a firm understanding of the mission's scope, the 864th began to execute the eight-step training model early on so as to use this valuable training mission to the fullest.

Plan the Training

One year before the mission's execution, the battalion S3 attended a Cobra Gold '99 preplanning meeting in Bangkok and, in July 1998, a Concept Development Conference was held in Hawaii. Throughout the rest of 1998, the battalion staff continued to collect information and coordinate future contracts for the mission that was planned for May 1999. Meanwhile the battalion's construction section gathered everything it could from previous Cobra Gold missions. After-action reviews and plans from those exercises helped ensure that many of the challenges faced in the past would not arise again.

Train and Certify Leaders

In early January 1999, the task force narrowed the concept of the operation to four construction sites—three would be completed by Alpha Company's two vertical construction platoons, and Seabees from the 5th Naval Marine Construction Battalion would complete the fourth. During the battalion's annual construction conference, OICs and NCOICs updated their project-management skills, to include learning to use the new Sure Track software program by Primavara. More importantly this conference allowed battalion leaders to ensure that project leaders understood and adhered to the battalion's high standards.

As a final predeployment certification, each OIC gave the battalion commander a preconstruction brief that included details of how the OIC planned to accomplish each mission. The briefs were of special importance because the construction sites were located hours from each other and in some of the most

Soldiers from the 864th Engineer Battalion construct the foundation system for a multipurpose building in Thailand.

remote areas of Thailand. This meant that the majority of the command and control would rely on expertise of the site OICs and NCOICs.

Recon the Site

In February a reconnaissance team consisting of Alpha Company's executive officer, a site NCOIC, and part of the battalion's construction section visited Thailand to get a firsthand look at the sites. The team took photographs and videos and established the basis of good relations with each village leader. The team determined the best means of providing each site with essential life-support supplies and contracts. Meanwhile, the battalion's construction team established and finalized bill-of-material contracts and met with its Thai army counterparts for each site.

Issue the Plan

After compiling information from the reconnaissance team and the OIC's planning, the task force issued a comprehensive plan early in March 1999.

Rehearse

To ensure the success of a mission, there is no substitute for quality construction rehearsals. So for more than a year before the execution of Cobra Gold '99, the 864th sought construction missions that were similar to those it would perform in Thailand. In August 1998, Alpha Company's 1st Platoon completed a mission for the 3d Ranger Battalion that involved constructing four different walls at one of the ranges so the rangers could train on urban demolition. While constructing three of these walls, the company placed more than 1,500 concrete masonry blocks—an outstanding rehearsal for Cobra Gold, where it placed more than 3,000 blocks. Alpha Company's 2d Platoon constructed a 50- by 100-foot Butler building at the post's Regional Correctional Facility. This project involved pouring a 60- by 105-foot concrete pad, which was excellent preparation for the 80- by 40-foot pads it built in Thailand.

Before the deployment, Alpha Company focused on some of the more unique construction challenges it would face. For example, the platoons had never constructed the type of roof they would build in Thailand, so for practice they took on a small project in the company's motorpool. For years, Alpha Company's vertical platoons had practiced laying block on a small 16- by 14-foot pad. The battalion's construction section designed and built a roof for the pad that was similar to the roof design and materials the company would use in Thailand. In completing the roof, Alpha Company discovered many of the challenges that might arise and resolved in detail how to meet these challenges long before the company arrived in Thailand.

The foundations of the buildings in Thailand were also unique. With concrete footers and precast reinforced concrete columns as the structures' main support system, Alpha Company incorporated a grade beam system that tied each of the columns together. To rehearse this particular task, the company constructed a similar foundation system with only four columns. As an added benefit, this foundation would act as the company's new block training foundation, replacing the shed it had put a roof on earlier. Just as with the roof, the lessons learned from constructing this new foundation system helped leaders avoid construction problems in Thailand before they occurred.

Rehearsals such as these offered not only an opportunity for leaders to refine their plan but also gave the soldiers and NCOs a chance to practice and determine the best and most efficient way to accomplish each task. By conducting rehearsals that closely mirrored the actual training in Thailand, the task force ensured that all sites could meet the deadline for completing the construction projects.

Execute

On 15 April, the task force sent the construction section and Alpha Company's executive officer to Korat, Thailand, to ensure that coordination the reconnaissance team had done earlier was still in place. On 20 April, the four-man advanced party

Thai military and civilians join soldiers from the 864th Engineer Battalion at one of the Cobra Gold '99 projects.

teams deployed to ensure that the footers were placed and the columns erected within 10 days. The main body of 85 soldiers departed from McChord Air Force Base, Washington, on 28 May and began the 29-hour flight to Thailand. They had 20 days to complete the remaining 90 percent of the project. By the time the 864th left Thailand, it not only had built four outstanding structures but also had strengthened relations with the Thai military and civilians.

Conduct an AAR

Throughout the project, OICs maintained a log of after-action-review comments, as-built drawings, and a record of additional bill-of-materials (BOM) purchases. When it returned to Fort Lewis, the construction section compiled this information with its own comments and those of the leaders into a valuable package for the next Cobra Gold exercise.

Retrain

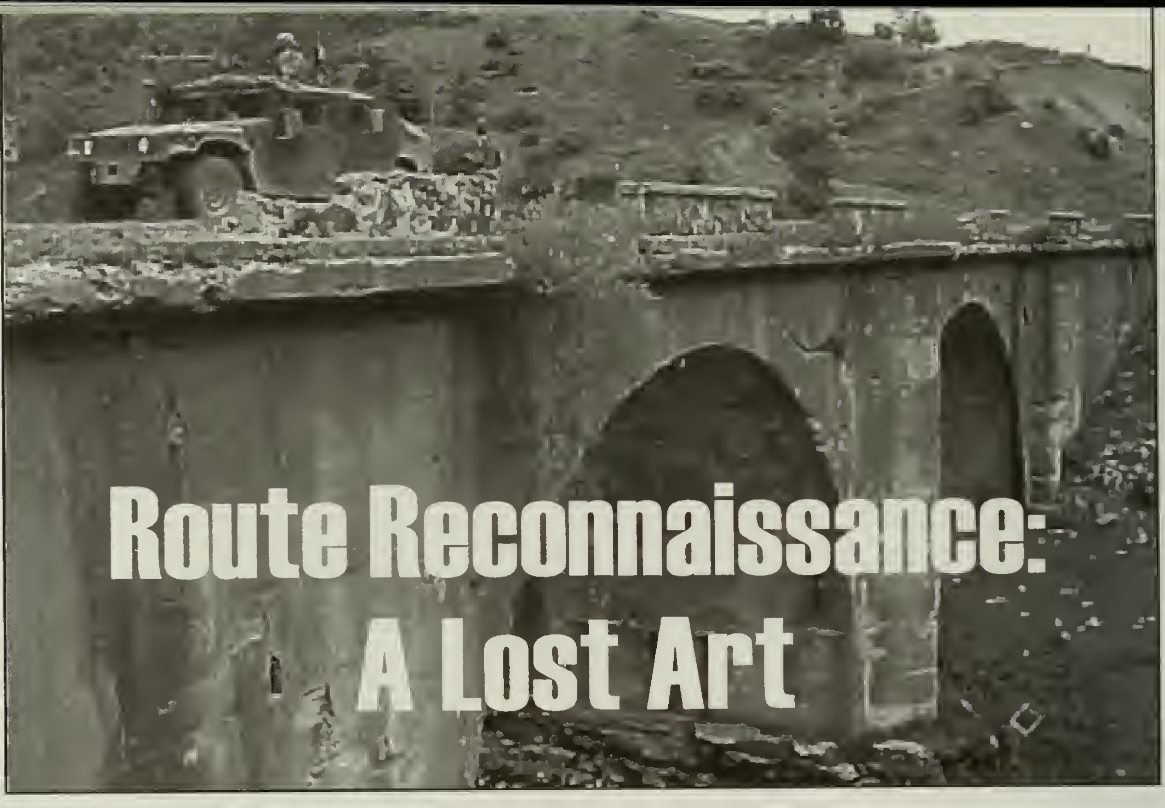
Using the lessons learned from Cobra Gold '99, the 864th Engineer Battalion staff already has started to plan for the battalion's involvement in Cobra Gold 2001. Although Cobra Gold '99 was quite successful, everything did not go according to plan during the exercise. All of the sites experienced design changes, BOM shortages, and some weather problems. Yet, the effects of these ever-present challenges on the overall mission were minimal because of the time saved and the lessons learned during the battalion's execution of the eight-step training model.

Conclusion

Planning as much as a year before executing the mission limited the number of design changes. *Training and certifying leaders* gave them the confidence and skill to make the right call in the face of adverse conditions and situations. *Reconnaissance of the site* ensured that leaders knew what to plan and could provide soldiers what they needed to get the job done. *Issuing the plan* ensured that everyone down to the lowest level understood their role in the training's execution. *Rehearsals* revealed problems to be addressed and trained soldiers on tasks where they lacked proficiency. *Execution* gave everyone an opportunity to see what they could do with what they had learned in a real-world training situation. The *after-action review* provided quality feedback on what to maintain and what to change the next time around when the battalion *retrains* during the Cobra Gold 2001 exercise.

Although the 864th was commended for completing one of the most successful missions in the 18-year history of Cobra Gold, the success was also a tribute to the effectiveness of the Army's eight-step training model.

First Lieutenant Luzzatto is a vertical construction platoon leader, A Company, 864th Engineer Combat Battalion (H), at Fort Lewis, Washington. He served as battalion construction officer for the 864th while deployed to Kosovo from July 1999 to January 2000. First Lieutenant Luzzatto is a graduate of the United States Military Academy and the Engineer Officer Basic Course.



Route Reconnaissance: A Lost Art

By Captain Matt Pasvogel

On 8 April 1999, the first elements of Alpha Company, 40th Engineer Battalion, deployed from Germany with Task Force 1-6 Infantry as part of the initial-entry force to Albania. Based on the initial mission analysis, our engineers were prepared to conduct high-intensity conflict and force-protection tasks. After the first few days in Albania, the situation and mission expanded from protecting the force to establishing a forward operating base for future operations. This base was more than 150 kilometers from our base in Tirana, Albania. While performing initial route-reconnaissance missions, we realized that they were very different from the heavily rehearsed and trained engineer obstacle-reconnaissance missions.

It did not take long to push forward the appropriate manuals and equipment to support the initial-entry force before the rest of Alpha Company arrived on 3 May. The company eventually reconnoitered more than 500 kilometers of roads and several tunnels and ferry sites and classified more than 90 bridges in Albania. Because many of today's military missions initially occur in countries with underdeveloped lines of communication, engineers must be well-trained in the vital mission of route recon. This article highlights some of the important doctrine, training, leader development, organization, materiel, and soldier (DTLOMS) issues as well as lessons we learned concerning route recon.

Doctrine

Alpha Company personnel found that Field Manuals (FMs) 5-170, *Engineer Reconnaissance*, and 5-34, *Engineer Field Data,* are packed with information that is essential to conducting a successful engineer recon. FMs 5-170 (Chapter 5) and 5-34 (Chapter 3) outline several methods for conducting these missions and describe how to properly fill out the various reports. Our recon teams and squads used these methods as guides for gathering route information and compiling it in an understandable format to pass on to higher maneuver and engineer headquarters. We developed a checklist from these two manuals to remind team leaders of the various aspects of recon missions (see Figure 1). Our current doctrine, coupled with some mission checklists, contains sound tactics, techniques, and procedures (TTP) for accomplishing route-reconnaissance missions.

Recon Checklist/Limitations

- ✓Curves < 25 meters or 82 feet
- ✓Gradients > 7 percent
- ✓Inadequate drainage
- ✓Poor surface conditions
- ✓Road width < 4.0 meters
- ✓Overhead clearance < 4.3 meters
- ✓Bridge military load class (bypass possibilities and bridge degradation)
- ✓Shoulder softness/caving
- ✓Potential quarries, lumberyards, cement, and lime
- ✓Turnouts/turnarounds
- ✓Obstacles to movement
- ✓Rock slide areas

Figure 1

Training

Although Alpha Company personnel did not focus on route recon before deploying, our junior leaders developed training plans and constructed rehearsals while in Albania. The engineer battlefield assessment from the mission analysis and a map recon provided a good start toward determining the features we needed to classify along the route. After deciding on the critical features to be reconnoitered, we used similar features within the perimeter of the Task Force Hawk base, if available, to conduct training and rehearsals. Within the base were many small bridges, sharp turns, narrow roads, and areas of insufficient drainage. Our sappers used spare time between missions to conduct butcher-board classes and walk-through exercises. It may not always be feasible to conduct training on actual features while deployed, but key leaders must conduct rehearsals of anticipated features using rock drills and walk-through exercises.

Leader Development

With all the high-intensity-conflict training needed at the home station, we found it hard to dedicate the time and resources needed to train soldiers and leaders to standard on route-reconnaissance tasks. Because of our level of training before deploying, we constantly disseminated new TTP or lessons learned as they developed. Every time a recon team completed a mission, the leader back briefed the engineers at the tactical operations center (TOC) concerning the team's compiled data. The back brief also included any new techniques the team discovered and validated. The TOC disseminated that information to other leaders during daily operations meetings or mission rehearsals. Conducting thorough rehearsals and sharing information were very helpful to engineer leaders at all levels.

Organization

Alpha Company categorized its engineer recons as initial, intermediate, or deliberate, depending on the time allowed and the enemy situation. During the initial or leader's recon, there was little time for engineers to gather detailed data. These recons usually consisted of a senior NCO or platoon leader riding with the task-force commander to get an initial assessment of the route. The engineer took digital photos to use for making an initial assessment of whether a feature might constrain vehicular movement.

After the initial recon, we tailored a team of four to six engineers to conduct an intermediate recon. While on this mission, the soldiers measured and collected data to help assess the route classification accurately.

Once the route was classified, engineers conducted one final recon, if it was needed. This deliberate recon consisted of heavy engineers, heavy equipment transporter operators, heavy wheeled-vehicle operators and, if they were available, U.S. Army Corps of Engineers representatives to further assess whether calculated constraints could be eliminated by constructing bypasses, upgrading roads, reducing curves, or repairing and/or reinforcing bridges.

At each stage of the mission, the data gathered was passed on to higher headquarters to help develop a route database for

A soldier measures a bridge section during a reconnaissance mission.

Task Force Hawk. In the future, whatever technique units use, they must not create "cookie-cutter" teams. They must ensure that recon elements are organized based on the task or mission.

Materiel

Almost all of the recon missions involved high-mobility, multipurpose wheeled vehicles (HMMWVs). At a minimum, the front and rear vehicles had mounted crew-served weapons during every movement. Each engineer team used similar equipment to help gather necessary data. The key pieces of equipment were a Global Positioning System, a digital camera, and a tape measure. These three items were part of the basic load any time a recon team went on a mission. When these teams conducted training and rehearsals, they developed a list of equipment that would help them execute their drills. We recommend that units develop recon kits that contain equipment essential to mission success. Figure 2 shows a sample checklist for a bridge recon.

Soldiers

We found that soldiers need some basic skills or abilities to be part of a recon team. For bridge recons, especially in the mountains, soldiers must not be afraid of heights. They must be agile enough to climb around or lean over the edges of bridges to measure various areas. In Alpha Company, each team identified its good swimmers in case the mission involved taking measurements over water. We picked soldiers who understood the types of data we needed to collect and the formulas used to calculate constraints or the military load class of a bridge. We found it necessary for a recon team to train and rehearse so that leaders could identify soldiers who possessed the skills needed to conduct various tasks.

Bridge Recon Checklist

✓Global Positioning System
✓Digital camera
✓Tape measure (100-foot)
✓Binoculars
✓Safety rope
✓Report forms
✓Radio
✓FM 5-170
✓FM 5-34
✓Map sheet
✓Compass and protractor
✓Calculator

Figure 2

Lessons Learned

As with many real-world deployments, units must develop training programs to compensate for tasks that are not a part of their mission-essential task list or that they could not train before deployment. Alpha Company personnel learned the following lessons during their deployment to Albania:

- **Doctrine**. Learn our doctrine, because it is sound, and use it.
- **Training**. Continue to develop training programs while deployed.
- **Leader development**. Conduct rehearsals and training to certify leaders.
- **Organization**. Avoid "cookie-cutter" recon teams; tailor them to the task or mission.
- **Materiel**. Develop checklists to complete various types of recons.
- **Soldiers**. Identify soldier skills needed for critical tasks.

Units should develop sound training plans that support their missions and develop SOPs as they are needed. Our Army doctrine provides an excellent foundation that will allow soldiers and leaders to succeed. We must not send untrained soldiers into harm's way in real-world deployments.

Captain Pasvogel commands Alpha Company, 40th Engineer Battalion, Germany, and recently deployed to Albania in support of Operation Noble Anvil. He was previously a training and doctrine staff officer in the Office of the Deputy Chief of Staff for Engineering, U.S. Army Europe. CPT Pasvogel is a graduate of the U.S. Military Academy and the Engineer Officers Advanced Course and holds a master's degree in engineering management from the University of Missouri-Rolla.

A Guide to the U.S. Army Engineer Museum

By Kim Combs

The U.S. Army Engineer Museum was established at Fort Leonard Wood in 1989 as a part of the Engineer School's move from Fort Belvoir, Virginia. The museum consists of an encyclopedic gallery, a chronological gallery, and a World War II historic community. In addition to these displays, there is a regimental store within the museum.

Encyclopedic Gallery

In an effort to support the instruction at both the Engineer School and the Maneuver Support Center, pieces of the material culture of American engineers are displayed in the encyclopedic gallery. Five aspects of the Army engineer mission are highlighted: topographic engineering, land-mine warfare, tactical bridging, demolitions and explosives, and arms and ammunition.

Topographic Engineering. The topographic engineering section displays the material culture of topographic engineers, surveyors, and cartographers from their colonial beginnings to the present. Gouvernor K. Warren's 1856 Pacific Railroad survey is used in the dioramas to interpret early field surveying. The cases exhibit map-making, drawing, and surveying equipment.

Land-Mine Warfare. This area contains American mines, mine detectors, and foreign materials that are significant to the development of U.S. equipment. The dioramas depict an engineer searching for mines in Vietnam and a World War II German antitank mine (the Goliath) on the Normandy beachhead. In the display cases are U.S. mine detectors, minefield-probing and marking materials, and American and foreign mines. There is a modern AN/PSS-11 mine detector set up where visitors can pivot the detector over mined terrain and listen for the different tones. Opposite the mine detector is a model minefield. By pressing the buttons, visitors can see various mine patterns from World War II to today.

Tactical Bridging. The tactical bridging exhibit includes models of floating, fixed, and mobile tactical bridges. Visitors walk on an authentic "double-double" Bailey bridge to see models of fixed bridges. Across from the fixed-bridge display is a diorama with models of several types of floating bridges. The gallery also contains several models of bridges and related equipment dating from the Civil War to today.

Demolitions and Explosives. One wall in this area contains objects relating to the recent history of the unique aspect of the Army engineers' mission. In display cases are items such as dynamite, C4, cratering charges, and bangalore torpedoes. Across from the wall are two dioramas. One contains a model railroad bridge rigged for demolition where visitors can press a button to see where different types of charges are placed. The other diorama depicts a typical oak tree that is ringed with explosives in preparation for creating an abatis. Between the dioramas is a 50-cap blasting machine where visitors can view a short video on military demolitions.

Arms and Ammunition. In this section, a diorama depicts an engineer outpost during World War I. Display cases along the walls contain weapons used by American Army engineers since the 18th century. Also displayed are swords, muskets, rocket launchers, mortars, and hand grenades. In the center of the back wall, visitors can try their hand at a piece of equipment the Army uses for modern marksmanship training—a laser rifle with a series of optically sensitive targets.

Chronological Gallery

The history of American Army engineers is interpreted in the chronological gallery. Displays concentrate on the Battle of Yorktown during the American Revolution, westward expansion, and the Mexican-American War. The Civil War area contains an original ponton; the Spanish-American War display follows. In the World War I section, a trench has been recreated, and the World War II area shows a D-4 bulldozer in action. A timber trestle bridge in the Korean War display is followed by a mine-detecting jeep from the Vietnam War. The Desert Storm exhibit shows an interpretation of war on the home front as well as in the desert.

This gallery includes an Engineer Hall of Heroes, which is designed to inspire and reinforce the basic idea that every individual who has proudly and honorably served the Army Corps of Engineers during the past 200-plus years is indeed a hero.

World War II Historic Community

In 1981, Fort Leonard Wood set aside 12 World War II temporary mobilization structures, part of the installation's museum. This group of buildings has been restored and now serves as the only preserved and interpreted World War II company area in the Army. The grouping consists of four barracks, two mess halls, three day rooms, two orderly rooms, and a regimental commander's quarters. Each building has been restored to the condition it would have been in

(continued on page 36)

The Army School System: One Army, One Team, One Standard

By Major Maurice E. Gissendanner

As the Army trains its personnel during the twenty–first century, it will use The Army School System (TASS) to ensure that Active Component (AC) and Reserve Component (RC) personnel are trained to the same standard. Active and reserve training institutions will use identical equipment, material, and certified personnel to provide standardized training to the force.

Over time, each of the Army components—Active, National Guard (ARNG), and Reserve (USAR)—developed independent school systems, which gradually developed separate standards. The Army School System, formerly known as the Total Army School System, now creates one system with identical tasks and standards for all three components.

A composite of the AC, ARNG, and USAR institutional training systems, TASS is composed of accredited and integrated AC, ARNG, and USAR schools that provide standard institutional training and education to Army personnel.

Using TRADOC Regulation 351-18, *The Army School System*, as a guide, the Army's goal is to provide standardized training and education through the efficient use of—

- Facilities, equipment, personnel, and time.
- The Army Training Requirements and Resource System (ATRRS), for entering training requirements and constraints.
- Total Army Training System courseware (TATS-C).
- Title XI personnel (The Title XI Program is the congressional action that authorizes and requires the use of active-duty commissioned and noncommissioned officers for dedicated support and evaluation of reserve units. Title XI personnel are assigned to proponent schools, TRADOC integration elements, and the RC TASS battalions.)

TASS Battalions

Currently, TASS is focused on the RC training institutions. In 1994, RC TASS battalions began to replace the U.S. Army Reserve Force (USARF) school battalions. Since then, RC engineer TASS battalions have reclassified 12,287 soldiers into the Engineer Regiment.

Command and control of the RC TASS battalions resides with the U.S. Army Reserve Command (USARC) and the National Guard Bureau (NGB). However, several major changes occurred when RC TASS battalions implemented the new school system. They—

- Became functionally aligned with their proponents for accreditation and instructor certification (for example, the U.S. Army Engineer School aligned with Engineer School battalions).
- Teach functionally aligned courses using only proponent courseware (for example, TASS engineer battalions teach only engineer courses).
- Became responsible for training all customers who reside within their region (see figure, page 19).

There are nine engineer RC TASS battalions. Seven reside within CONUS and two reside OCONUS (the Combat Support Battalion in Puerto Rico and the 4960th Multifunctional Training Brigade in Hawaii). All RC TASS battalions within CONUS are accredited. The two OCONUS battalions are scheduled for an accreditation evaluation during FY00 and FY01, respectively. AC TASS battalions will be incorporated into the TASS accreditation schedule during FY02.

TATS-C

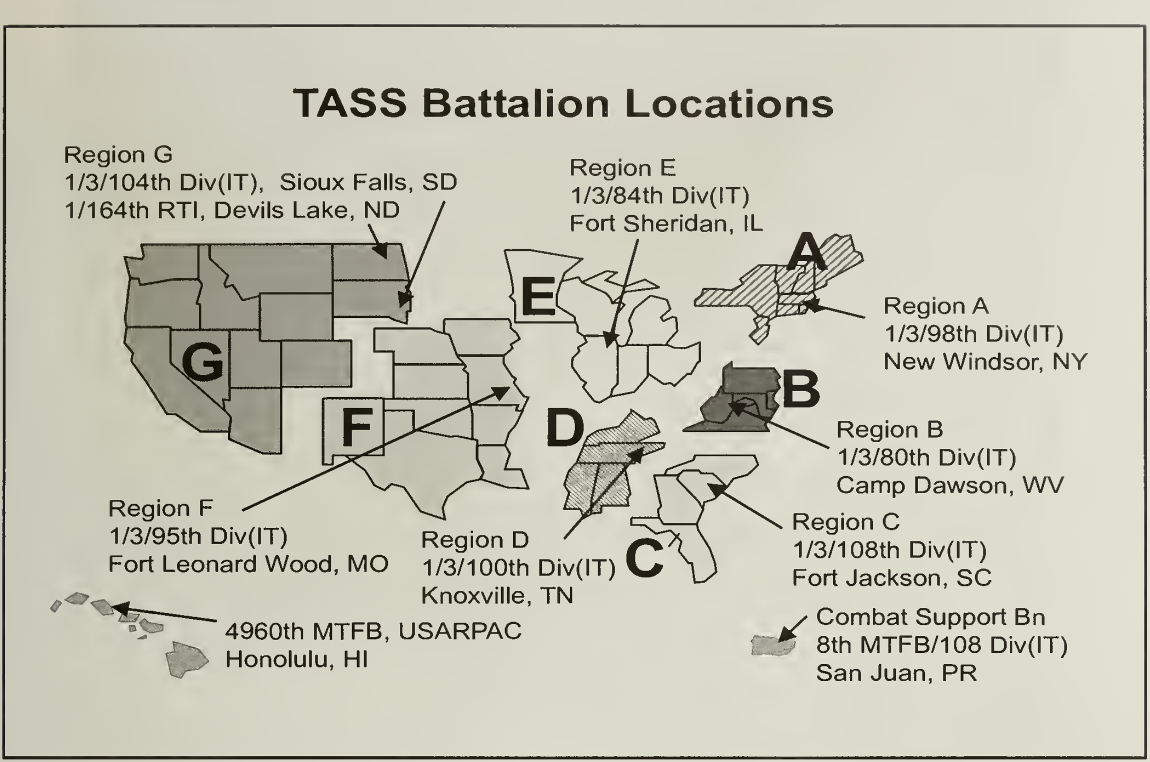
Implementation of TATS-C will ensure that AC and RC training institutions train soldiers to the same standard. TATS-C will replace the AC courseware and the RC configured courseware (RC3) that was formerly taught in USARF schools. RC3 primarily included those tasks needed to prepare reservists for mobilization, not necessarily all the tasks for which AC soldiers trained. Performance standards differed and trade-offs were made for reservists because of their time constraints.

TATS-C will have little impact on how AC TASS battalions operate, but it will significantly impact inactive-duty training (IDT), weekend drill, and phase 1 of military occupational specialty qualification (MOSQ) training for RC TASS battalions. Currently, under RC3, RC school battalions teach only combat engineer training (CET) during IDT. This is normally completed within two or three monthly drill periods. TATS-C has added some technical training to phase 1 of MOSQ training, which requires RC TASS battalions to conduct additional IDTs. Annual training requirements for RC TASS battalions will not change.

Engineer TATS-C is due out to the Engineer Regiment no later than 4th quarter FY00 (less the 51T10, 51T30, 62N40 courses and the Engineer Captain's Career Course) and will be implemented no later than 1st quarter FY02.

Accreditation

The Engineer School's TASS Division began official accreditation evaluations in 1997. According to a schedule set up by TRADOC, every three years proponent schools will evaluate the TASS battalions that are functionally aligned with them.



During an accreditation year, an evaluation team (comprised of Title XI and RC personnel) evaluates at least one annual training period of a TASS battalion and at least one-third of its IDT periods. All training sites must receive a "GO" rating for a TASS battalion to become accredited.

The evaluation team uses checklists from TRADOC Regulation 351-18 to evaluate the TASS battalions. One checklist covers training support, which includes requisition procedures, test-control procedures, and student and instructor record keeping. The other checklist covers conduct of training, which includes classroom and field instruction, instructor techniques, and use of equipment and training aides. RC engineer TASS battalions are well on their way to consistently providing standardized training to engineer soldiers, which translates into accreditation for the battalions.

Distance Learning

Eventually, TASS will take on the dimension of providing distance learning (DL) to soldiers. At the center of the DL concept is the DL Classroom, an Army initiative to place high-tech classrooms throughout the military community. The current TRADOC plan calls for fully implemented DL by 2010. By that time, TRADOC expects that 66 percent of our soldiers will receive DL and that 99 percent of our soldiers in CONUS will be located within one hour of a DL facility.

Conclusion

Under TASS, the Engineer Regiment will be able to apply multiple means and technologies to deliver standardized training to soldiers and units at the right place and time. No matter where our soldiers are located, they will be able to receive the same training taught by proponent certified instructors.

To make TASS successful, we need your feedback on what is working and what needs to be improved in our individual training courses. These courses belong to you, and TASS is your school system. Use them effectively to ensure that our soldiers get the training they deserve.

Send comments and suggestions to Commandant, U.S. Army Engineer School, ATTN: ASTE-DOT-SS, 320 Engineer Loop, Suite 336, Fort Leonard Wood, Missouri 65473-8929; or via e-mail to *gissendm@wood.army.mil.* The telephone numbers are DSN 676-4106 and commercial (573) 563-4106.

Major Gissendanner is chief of The Army School System Division, U.S. Army Engineer School. Previous assignments include platoon leader and executive officer, 175th Engineer Company (TOPO); platoon leader, 362d Engineer Company (CSE); executive officer, 100th Engineer Company (TOPO); S2 and assistant S3, 536th Engineer Battalion (Combat Heavy); commander, A/536th Engineer Battalion: and project officer, Galveston District, U.S. Army Corps of Engineers.

References:

1. TRADOC Regulation 351-18, *The Army School System.* 31 March 1999.
2. "Total Army School System," *Engineer.* December 1996.
3. TRADOC memorandum, subject: "Total Army Training System (TATS)." 25 March 1996.
4. TRADOC TATS/DL Workshop. 29 April – 2 May 1996.

The Army Engineer Diver

By Captain James Kisiel and Master Sergeant Marcus King

Yes, the Army has divers. Unlike the combat diver additional skill identifier held by soldiers in the Special Forces, engineers have military occupational specialty (MOS) 00B divers. A part of career management field 51, MOS 00B is a low-density MOS. The rank structure for this MOS ranges from private to master sergeant. However, since there is a constant need for new divers in the field, specialists and below may qualify for reclassification into MOS 00B.

Department of the Army Pamphlet 611-21, *Military Occupation Classification and Structure*, and Army Regulation 611-75, *Management of Army Divers*, list the requirements for diver application. The training required to become a diver is very demanding but also very rewarding. Phase One is a nine-day course taught at Fort Leonard Wood (see Engineer Update, page 48). Phase Two is a 26-week course taught by a multiservice instruction team at the Naval Diving and Salvage Training Center, Panama City, Florida.

Capabilities

Dive teams are a critical asset to commanders. Both Force XXI and Army After Next units will have to cross rivers and overcome the problems that involve rivers in areas of operation. Engineer divers can conduct waterway reconnaissance, which will save time for bridging units and prevent damage to their limited assets. Divers can provide nearshore and farshore topographic and hydrographic reports, measure and plot river depths to reveal the true channel, and measure possible nearshore and farshore exits. Maneuver commanders must know if bridges will support maneuver-force traffic. Divers can make this determination quickly, allowing the force to keep its momentum.

In addition to security and river-crossing missions, divers can dismantle or create waterborne obstacles, which makes them a countermobility and mobility asset down to the task-force level. Divers can emplace precision demolition charges to deny the enemy access to key structures and facilities, such as bridges and dams, and stop his momentum. Divers also can emplace and remove mines in shallow-river mining operations.

Dive Teams

The Engineer Regiment has four light dive teams (each with 22 soldiers) and two heavy dive teams (each with 25 soldiers). The light teams are stationed at Fort Eustis, Virginia, along with one heavy team. The other heavy team is stationed in Hawaii. The teams at Fort Eustis are configured by FORSCOM as a provisional company.

Light Dive Teams

Engineer light dive teams support the scuba and surface-supplied-air diving (helmet diving with air hoses from the surface to the diver) requirements of maneuver commanders. Light teams emplace and reduce underwater obstacles and minefields; repair damaged bridges, locks, dams, pipelines, canals, and levees; and construct underwater bridge structures, obstacles, and floating barriers. Some of these capabilities are required in humanitarian-assistance operations but, inevitably, most will be required in any theater during war.

Light dive teams have nonarmored vehicles and are highly mobile. They can conduct many missions without external aid but depend on support from other units, such as scouts and mechanized-engineer and combat-support-equipment companies, to perform construction and salvage missions.

Heavy Dive Teams

Engineer heavy dive teams support the scuba and surface-supplied-air diving requirements of commanders in charge of ports, harbors, and coastal zones. These teams enable commanders to construct port and logistics-over-the-shore structures and facilities as well as floating barriers. Heavy teams also can repair damaged piers, docks, wharfs, seawalls, and breakwaters; clear and mark inland navigational waterways; and collect underwater terrain and structure information.

Heavy dive teams also have nonarmored vehicles and are mobile. They can conduct many missions without external aid but depend on support from other units, such as engineer-port-construction and combat-support-equipment companies, to perform construction and salvage missions.

An Army diver decends into a partially sunken wreck.

The primary differences between the construction and salvage capabilities of light and heavy dive teams are the focus and the command-and-control assets. Heavy teams have additional specialized equipment and focus on construction and heavy salvage in ports and harbors. More experienced senior leaders of heavy teams are used extensively to plan and manage theater diving missions.

Protecting the Force

Dive teams have been a part of numerous operations but often are overlooked because of their size and relative obscurity. The performance of divers during their deployments to *Operation Desert Storm* and *Operation Restore Democracy* are two prime examples of how they have protected the force. In *Operation Desert Storm,* dive teams provided waterborne security for ports in Kuwait and Europe. They conducted hull surveys on cargo ships and barges to ensure that vessels were not mined. These surveys were critical because of the nature of the explosive cargo on many of the vessels. Similarly, in *Operation Restore Democracy*, dive teams provided waterborne security for Army vessels that entered unsecured ports in Haiti.

Engineer light and heavy dive teams are critical assets to the Engineer Regiment. These teams assist maneuver and port commanders in a variety of missions that focus on the onward movement and protection of U.S. forces. Water does not have to be an obstacle or a security threat to our soldiers. Enlist the help of engineer divers, and command the water space!

Captain Kisiel formerly commanded the Engineer Dive Company at Fort Eustis, Virginia.

Master Sergeant King is the Senior Career Management NCO, CMF 51, for the Engineer Personnel Proponency Office, U.S. Army Engineer School. He was previously the first sergeant of the 518th Engineer Company, Fort Kobbe, Panama.

Engineer Doctrine Hierarchy and Publications Renumbering

By Lieutenant Colonel Harry Rossander

The U.S. Army Engineer School and TRADOC are revising the Army doctrine hierarchy and numbering system to be more in line with the Joint doctrine hierarchy and numbering system. Changing the method of numbering and titling Army doctrine manuals will ensure a seamless link between Army and Joint doctrine. TRADOC personnel anticipate that these revisions will help groom young Army officers for Joint, interagency, and multinational military operations; help Army headquarters plan, prepare, and conduct Joint operations; and enable us to move in concert with the Joint doctrine system and the NATO doctrine system as they embrace improvements related to the twenty-first century.

The new doctrine hierarchy consists of a three-tier system for placement of field manuals (FMs) (see *Engineer*, April 1999, page 27). The top tier contains FMs with a direct link to a specific Joint publication, or the scope of the FM addresses multiservice and combined-arms operations. FMs 5-100, *Engineer Operations*, and 90-13-1, *Combined-Arms Breaching Operations*, are examples of manuals on this tier. The second tier contains proponent publications that are branch-specific and address how that branch fights or supports the fight. An example is FM 5-71-100, *Division Engineer Combat Operations*. Third-tier publications are primarily technical in nature, such as FMs 5-34, *Engineer Field Data*, and 5-434, *Earthmoving Operations*.

To implement the new hierarchy and align our publications more closely with Joint manuals, a new numbering convention was proposed by the Engineer School. This new numbering convention follows guidelines found in (draft) TRADOC Regulation 25-36, *The TRADOC Doctrinal Literature Program (DLP)*, and allows us to put some rhyme and reason into how our publications are regimented.

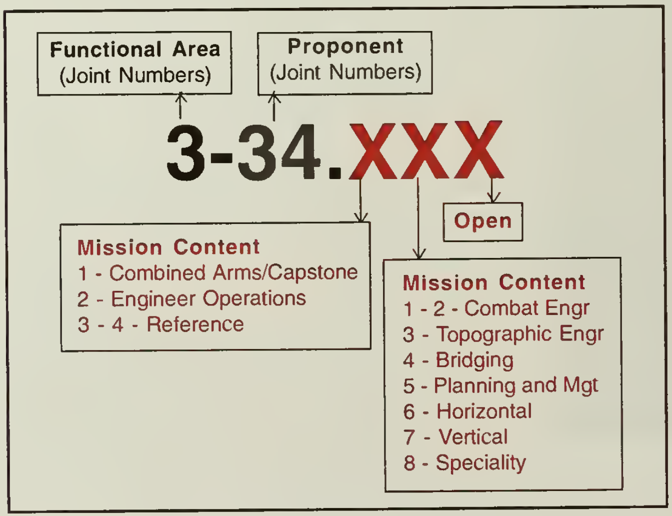


Figure 1. Numbering Convention

Joint Publication (JP) 3-34 is the Joint engineer manual. All engineer manuals will begin with 3-34 and will be followed by a three-number extension. The only exception to this rule will be the engineers' capstone manual, FM 5-100, which will be renumbered as FM 3-34. The first number in the extension will be denoted as shown in Figure 1. This extension number will make it possible for users to quickly determine the tier and the function of the manual. The second number in the extension will permit further segregation of publications by subject matter, something we have been unable to do in the past. The final number in the extension will enable us to put more than one publication in any category and will allow for future expansion.

The new hierarchy and numbering convention was specifically designed so publications can be tracked across all tiers and functional categories. In addition, with this new system, we can more uniformly align with existing Joint doctrinal publications.

The plan for adopting the new numbering system is to introduce it on publications as they are revised, beginning with FM 5-100. However, for at least one publication cycle, both the old and new numbers will be shown on the cover. In addition, a cross-reference system will be developed to enable users to find a publication by either the old or the new number.

Currently, engineers have the second largest publications library in the Army, with responsibility or proponency for more than 90 manuals. In addition to implementing the new doctrine hierarchy and numbering system, Engineer School personnel are reducing the number of manuals to 70 or less in the next two years (see Figure 2). This will be done through review, validation, and consolidation of existing doctrine. The Engineer School will be seeking subject-matter experts from both the schoolhouse and the field to help review and revise many of the existing publications.

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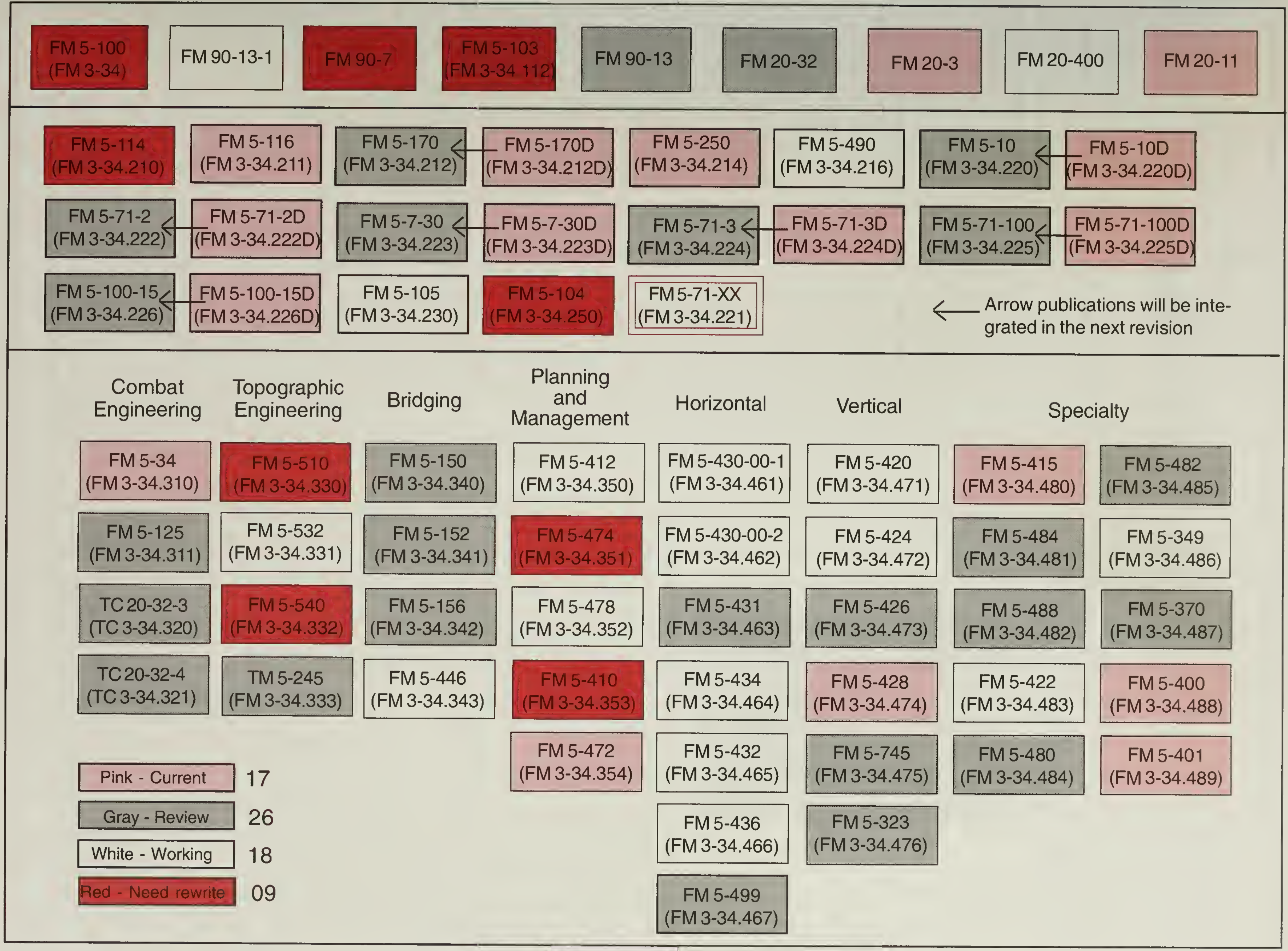

Figure 2. New Hierarchy for Publications

Book Review

Flame On! U.S. Incendiary Weapons, 1918-1945, by John W. Mountcastle, White Mane Books, Shippenburg, Pennsylvania, 1999, 206 pages, list $29.95 (hard cover). Available on-line from *http://www.Amazon.com.*

This book is a detailed, scholarly work by the former Chief of Military History for the U.S. Army, Brigadier General John W. Mountcastle. Beginning with incidents in the Old Testament, the author describes the early history of flame weapons. He includes information on such interesting topics as the use of a primitive flamethrower by attacking Boeotians during the siege of Delium (424 B.C., during the Peloponnesian War) and the development of "Greek Fire" by the Byzantine engineer Kallinokos. However, the development of flame weapons remained episodic until the German manpacked flamethrower made its combat debut in World War I.

Richard Fiedler, a chemical engineer in Berlin, invented the first modern flamethrower prototype in 1901. Early in the development, the German Army recognized that to function effectively the ungainly flamethrowers required carefully trained operators and mechanics. When the Germans mounted the first attack with flamethrowers on 26 February 1915 against French troops in the Malancourt Forest near Verdun, the French fled in panic. As a result, the Germans organized the Third Guard Pioneer (combat engineer) Battalion, under the command of Captain Redemann. As the war progressed, the pioneers' flamethrowers became an integral part of German "storm-troop tactics."

The early manpacked flamethrower was a difficult and dangerous weapon to use. However, when combined with other technical innovations (such as modern grenades, trench mortars, chemical warfare and, belatedly, the first German tanks) and the tactical flexibility inherent in the pioneer corps, the result was a highly effective combined-arms team at the company and battalion levels. Led by their "sturmpionier," the German storm troopers were able to restore operational maneuver to the deadlocked western front by using flexible, dismounted-infantry tactics at the same time the Allies were turning to the tank, an invention of British Royal Engineer Edwin Swinton.

Another item of note was the use of a specialized workshop unit to maintain and modify the pioneers' equipment as necessary, further enhancing their flexibility and timeliness. This stands in stark contrast to the standard development processes of the American procurement bureaucracy.

As latecomers to the First World War, the Americans had to play catch-up in a number of areas. In the American Expeditionary Force, the Gas Service (the predecessor of today's Chemical Corps) was the responsibility of the Corps of Engineers. The 30th Engineer Regiment (Gas and Flame) under the command of Lieutenant Colonel Amos Fries (Corps of Engineers) was formed to provide support in this new area of chemical and incendiary warfare. The 30th Engineer Regiment (renamed the 1st Gas Regiment in August 1918) developed a close working relationship with its British counterparts, the Royal Engineers of the "Special Brigade." However, Lieutenant Colonel Fries had a strong bias against flamethrowers and preferred to focus on gas countermeasures. After the war, Congress authorized the establishment of the Chemical Warfare Service, with Fries as chief. During the interwar period, he continued to favor the development of chemical warfare agents over flame weapons. As a result, the United States continued to neglect developments in this area. However, this was not the case within the resurgent German military of the 1930s.

German pioneers, as well as their British counterparts, have historically maintained a strong interest in close-combat "assault engineering." This was demonstrated well in the stunning German victories over the West in 1940. Once again, the German attack was led by the pioneers. Indeed, a platoon of about 80 airborne pioneers (under the command of Lieutenant Rudolf Witzig, later the chief of the postwar Bundeswehr Pioneer School) made a dawn glider assault on the 700-man Belgian fortress of Eben Emael. This fort blocked the advance of the northern German pincer into the Netherlands and was considered to be one of the strongest forts in the world. Using flamethrowers and shaped charges (the latter was a secret weapon making its combat debut), the pioneers shocked the world by neutralizing the fort in 30 minutes. Through the insightful writings of Captain Paul Thompson (U.S.Corps of Engineers), this victory served as a wake-up to Americans on the importance of flame weapons and close-combat assault tactics.

Indeed, Thompson called for the American Corps of Engineers, which historically had a more construction-service-oriented outlook than their British and German brethren, to adopt a more aggressive role in combat and the new combined-arms philosophy. The Chemical Warfare Service responded by beginning to develop flamethrowers. Regrettably, the Corps of Engineers missed the opportunity to thoroughly shake off the peacetime, civil-works mentality of the interwar period and did not formally develop any specially trained engineer assault troops, forcing these to be improvised by combat engineers serving in the field. By the time American troops entered the ground war during *Operation Torch* (November 1942), the Chemical Warfare Service was able to equip each divisional engineer battalion with 24 M1 flamethrowers. However, engineers lacked the doctrine and training to use the new weapons effectively, which also suffered from lack of care and proper maintenance. The development of vehicle-mounted flamethrowers also suffered due to a strong aversion by the U.S. Army to the development of special-purpose armored combat-engineer vehicles (CEVs).

The lack of armored flamethrowers in Europe may have contributed to the difficulties Americans had on Omaha Beach on D-Day. Indeed, during the advance across northwestern Europe, they had to request support from British Crocodile flamethrower tanks to reduce German fortifications. The Americans found that often just a demonstration of a flamethrower within sight of the defenders was enough to induce surrender or withdrawal. In fact, General Patton was forced to improvise flamethrower tanks in the field and was quite pleased with the results.

In the Pacific Theater, however, the prevalence of close-combat operations against the Japanese in prepared defenses forced American units in the field to develop effective flame tactics. As a result, thoroughly trained, properly led provisional flamethrower units were developed in the field by the infantry and engineers of the Army and Marines. Indeed, the Marines stated that manpacked flamethrowers were responsible for breaching the Japanese defenses on Tarawa in November 1943. When some soft-hearted Americans protested the use of flame weapons, General George C. Marshall stood up for the lives of American citizens serving on the line in combat and stated, "Vehement protests I am receiving against our use of flame throwers don't indicate an understanding of the meaning of our dead on… Tarawa." American armored flamethrowers (fabricated in workshops on Hawaii using Sherman tanks) made their Pacific debut on Iwo Jima, where the first eight proved their worth. By the time the attack on Okinawa was launched, the 713th Armored Flamethrower Battalion had been formed with 54 flame tanks. The battalion was credited with 4,788 kills, with no losses of its own. As one magazine summed it up, "There are few arguments about fire; it saves U.S. lives and kills Japs."

Although the U.S. military continued to use flamethrowers in Korea and Vietnam, these highly useful weapons were recently relegated to war stock (if not retired), apparently for reasons of "political correctness." Indeed, flamethrower tactics were dropped from U.S. field manuals when FM 20-33, *Combat Flame Operations,* was superseded by FM 3-11, *Flame Field Expedients,* in 1990. Given the increased likelihood of having to conduct operations on urban terrain in the near future, it is a shame that a modern-day General Marshall did not stand up for the good of the American soldier and defend the retention of these useful weapons. The unpalatable fact is that there is currently no antiseptic way to conduct these operations. In fact, some of the most successful operations on urban terrain were undertaken by the Germans toward the end of World War II. These operations gave the Germans the opportunity to implement a number of lessons learned from the bitter battle in Stalingrad. They employed small combined-arms assault teams, which included pioneers equipped with flamethrowers and man-portable fuel-air explosives. These teams were supported by Sturmtigers (similar to the old CEV), remote-controlled vehicles, and pioneer half-tracks firing heavy rockets (nicknamed "Foot Stukas").

Operations in urban terrain are—and probably will remain—brutal, primitive, close-combat affairs. For our national strategy to be more than a piece of paper, the U.S. Army must have the means of making it a reality at the tactical level. Given the proven lack of public tolerance for U.S. casualties in strategically questionable undertakings in the Third World, we must do everything reasonable to minimize our losses. If we are to succeed in urban combat, while minimizing the loss of American lives, we would be well-advised to retain the flamethrower.

Although this review focused on the flamethrower, the book also provides an extensive discussion of air-dropped incendiaries and the moral issues involved in using fire bombing, particularly against cities like Hamburg, Dresden, Yokohoma, and Tokyo.

Combat engineers should find this book to be fascinating reading. It is recommended to all combat-arms leaders.

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Understanding AC/RC Assignments

By Major Diane T. Cummins-Lefler

"My next assignment will probably be an Active Component/Reserve Component (AC/RC) job. Isn't that taking me away from soldiers?"

Many of us, officers *and* enlisted, find ourselves repeating those or similar phrases. Too often we allow rumors of the past to determine our views on various assignment positions instead of conducting our own research. After serving for more than a year as a company commander in 1st Battalion (Training Support) (Engineer), 395th Regiment, at Fort Hood, Texas, I have a better understanding of what it means to be in an AC/RC job and how important this assignment is to the Corps of Engineers as well as to the Army. The purpose of this article is to help you to better understand AC/RC assignments.

Background

During the Gulf War, the Army had difficulties deploying the National Guard's "round-out brigades" and high-priority combat-arms units. The old methods and criteria of reporting readiness showed that the units were combat ready. However, when they arrived at their mobilization stations, their readiness reports were dismissed and the units were put through an extensive train-up period that included a National Training Center rotation. The entire mobilization and train-up process revealed numerous problems with the units' readiness, how readiness was tracked and reported, and how the AC interacted with the RC. There had to be a better way.

These experiences led Congress to push for a new system of training and evaluating RC units. In 1992 and 1993, Congress developed the Ground Forces Readiness Enhancement program, which dedicates extensive personnel and material resources to ensure that RC units are trained and ready for deployment. Congress directed realignment of the AC support to the RC with a focus on selected high-priority RC units. The Ground Forces Readiness Enhancement legislation resulted in the dedication of 5,000 experienced AC soldiers to train and evaluate RC units.

In the Engineer Regiment, this is an extremely vital mission, because 76 percent of the regiment is in the National Guard or Army Reserves. The corps-level units that all divisional engineers depend on for support reside in the RC and deploy with us when we fight. To train these units, there are six engineer training support battalions that work directly with combat engineer and bridge units. These battalions are devoted to helping engineer units reach and maintain combat readiness. *(Note: Combat heavy, topographic, and other "noncombat" engineers receive similar support from combat-service-support training-support battalions that are manned by Army Reserve soldiers with only a few active-duty team members.)* The combat engineer training-support battalions are located throughout the United States (Fort Hood, Fort Lewis, Fort Carson, Fort Knox, Fort Meade, and Fort Jackson) and train all of the priority RC engineer units.

In addition to the six engineer training-support battalions, there are resident trainers, AC officers, and NCOs who live and work with selected priority units every day. The focus of these teams ranges from individual and crew-level training to mentoring NCOs and officers at the company and staff levels on training management. The majority of these resident teams are in the 15 enhanced separate brigades of the National Guard and force-support-package Army Reserve battalions. Together, the training-support battalion and resident team help the RC commander achieve his readiness goals.

Operations

The 1st Battalion's mission is to teach, coach, and mentor combat engineer RC units. We do this through a variety of training events that culminate in combined-arms lanes-training exercises that are as close to a combat-training-center experience as we can replicate. To set units up for success at these events, we transport mobile training teams to unit drill locations to teach tactical skills and to certify unit leaders on critical tasks. We also conduct a weekend or an inactive-duty training (IDT) lanes exercise where we take the unit through the crawl-and-walk phases of the lanes-training process. This combination of teaching and assessing led to the title of "observer-controller/trainers (OC/Ts)," which captures the flow of our training year with the unit as well as our focus.

In the training-support battalions, we are all OC/Ts. We teach units their mission-essential tasks, conduct crawl-and-walk lanes during IDT, and then assume the full OC role during their

Soldiers conduct an after-action review with the 395th Battalion command group.

annual training (AT) rotations. Mobile training teams focus on train-the-trainer sessions. This method reinforces the units' chain of command by allowing them to teach their soldiers the tasks instead of having the OC/Ts do it. We instruct company and platoon leaders in doctrine or specific mission-training-plan tasks. At times, mobile training teams may also generate some individual or crew-level training on systems such as the MK19, Volcano, Modular Pack Mine System, and armored vehicle-launched bridge. While these systems have been in the AC inventory for years, many RC units are just now receiving them. Mobile training teams normally consist of two or three soldiers who go to a unit and provide instruction—usually in a classroom environment.

IDT is geared to collective-task lanes training, which focuses on the sapper platoon and takes the unit from the concept-of-the-mission training team to at least the crawl-and-walk phase. A normal IDT lasts two days, from 0800 Saturday to 1600 Sunday.

AT is the premier training event of the year, and everything we do is geared toward this training. Ideally, this is where we bring it all together in a combined-arms exercise. Each OC/T covers a platoon, and the NCOIC and commander cover the company headquarters. Normally, the operations tempo allows OC/Ts to rotate out of the field every third day for resupply runs.

After every IDT and AT, we produce a take-home packet, which is our primary written feedback mechanism to the units we assess. These packets are very high-quality, automated products that include—

- A cover letter from the commander.
- Platoon- and company-level training and evaluation outlines with comments and recommendations for training.
- A company summary for the entire training period that lists strengths and areas in need of improvement.
- A Training Assessment Models report.

OC/Ts can expect to spend more than 100 days each year on temporary duty or in the field, mostly between March and July, for IDT lanes and AT. More than half of the 100 days are limited field time. The remainder of the year is similar to that of any unit in garrison.

Engineer training-support battalions normally have three companies—each commanded by a branch-qualified senior captain (their second command) and five seasoned NCOs (all with successful squad-leader and platoon-sergeant time). The NCOIC's duties are similar to those of a first sergeant. Every soldier in AC/RC assignments brings a wealth of knowledge.

OC/Ts are picked based on their performance and experiences and go through a series of classes and testing before being certified. In our brigade, the certification process is a five-phase program that is monitored and tracked annually. In addition, we certify each OC/T on an extensive list of combat-engineer skills, to include using modernized demolition initiators and live mines. The final phase of our battalion's OC/T training is a "right seat" rotation at either the Joint Readiness Training Center or the National Training Center.

Conclusion

An AC/RC assignment can be challenging and demanding. We operate on the basis of sound doctrine and tactical and technical proficiency. In addition, one must have superior communication skills to teach, coach, and mentor leaders at the platoon level and higher. If you are looking for a rewarding, fast-paced, engineer-specific, doctrine-driven experience, look no further. Continue to make a difference in the future of engineer soldiers. Accept an AC/RC assignment and help achieve the *One Army, One Standard* goal.

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Constructing Pavements With Recycled Waste Materials

By James E. Shoenberger

The safe disposal of waste materials is an increasing concern in the United States and around the world. Even with the heightened awareness of the importance of recycling, the difference between the volume of waste materials generated versus the amount recycled continues to grow. Although many existing disposal facilities are reaching capacity, approval for additional facilities is becoming more difficult to obtain because of restrictive environmental regulations and objections by local residents. To help address these issues and provide information on one possible solution to the problem, the U.S. Army developed Engineering Technical Letter (ETL) 1110-3-503, *Use of Waste Materials in Pavement Construction.*

State and federal government regulations and policies have a strong influence on whether waste materials are used in pavement construction. Federal programs such as the 1976 Resource Conservation and Recovery Act and the 1984 Hazardous and Solid Waste Amendments promoted the use of waste materials or recycling. Federal interest in recycling was exemplified in the 1991 Intermodal Surface Transportation Efficiency Act that initially required all state Departments of Transportation (DOTs) to use a certain percentage of crumb (ground) rubber in asphalt mixtures. This requirement was later rescinded because of significant opposition from many states. Unfortunately, most state DOTs and other agencies handle requests for using waste materials on a case-by-case basis. So without the benefit of an established approval procedure, it is often difficult to use the materials.

Using waste materials in pavement construction not only reduces the amount of waste materials requiring disposal (which is costly) but also provides construction materials with possible savings over new materials. Because of the large volume of materials required for constructing pavements, they are favorable structures for recycling a wide range of waste materials.

Recycling may mean the reuse of materials removed from previous pavement structures, such as recyclable asphalt pavement, recyclable portland cement concrete, and various base course materials. Recycling may also involve using materials that do not originate from pavements; examples are slags, ashes, and various polymer materials. Existing design and analysis procedures are often inappropriate for mixtures containing waste materials; therefore, new procedures must be developed or existing procedures must be modified to make an application successful.

Specifications

Specifications exist for reclaimed asphalt and concrete pavements, scrap tires, iron and steel slags, fly ash, and plastic wastes. These materials have been widely used, particularly in areas of the country where they are produced. Construction specifications for using materials such as foundry sands for fills are the same as those for granular backfill materials. These specifications provide requirements for lift thickness and compaction. One requirement for satisfactory specifications is that suitable test and evaluation methods are available. In many instances, test methods developed for design and construction specifications are not readily usable in standard specifications.

The Corps of Engineers has a guide specification that covers the use of reclaimed asphalt pavement in hot-mix asphalt (Corps of Engineers Guidance Specification 02749). Technical Instruction 822-08 and Technical Manual 5-822-7, *Standard Practice for Concrete Pavements,* address the use of reclaimed asphalt and concrete pavements, iron and steel slags, and fly ash. The Corps of Engineers *Handbook for Concrete and Cement* contains standards CRD-C 255 and CRD-C 256 that pertain to specifying, sampling, and testing fly ash. These standards are also available in American Society for Testing and Materials C 618 and C 311.

Environmental Considerations

Possible environmental effects of using waste materials must be considered when planning pavement projects. This includes the effects of preparing the materials for use as well as the effects of constructing and using pavements. Investigations have been conducted into the environmental effects of many waste materials during pavement applications. These materials require special consideration since many of them are considered hazardous when used or stockpiled in nonpavement applications.

Cost Considerations

The economics of using waste materials in pavement applications must be favorable for their widespread use to become a reality. Economic benefits can be obtained through improved pavement performance or from reduced landfills. Consideration must be given to the effect that waste materials may have on pavement once it deteriorates to the point of requiring rehabilitation. Using waste materials in pavement construction will hinder future recycling if it means that the entire pavement structure must be considered hazardous.

Many claimed cost savings are based only on initial rather than life-cycle analysis. Accurate life-cycle cost analysis for most waste materials is difficult because of the limited number of applications of a particular material. True life-cycle analysis must include the initial cost, increased performance, and the effects of the waste-material recyclability of the pavement materials at the conclusion of its useful life.

Types of Wastes

The various types of waste materials can be divided generally into four categories: industrial, domestic, mineral, and agricultural. With time and changes and developments in technology, some of these materials will disappear from production, while new types will appear.

Industrial Wastes. As a group, these waste materials are probably the most widely reused. Industrial wastes generated in the United States exceed 400 million tons annually.

Domestic Wastes. The United States generates more than 200 million tons of domestic wastes annually. About 185 million tons are household or commercial wastes (trash or garbage). Of this amount, about 75 percent is placed in landfills, 11 percent is recycled, and 14 percent is incinerated.

Mineral Wastes. These wastes—about 1.8 billion tons annually in the United States—are by-products of various mining processes. They have had limited use in pavement construction, mainly because of transportation costs.

Agricultural Wastes. Produced in the United States at a rate of more than 2 billion tons annually, these waste materials are generally used where they are produced. They have a very limited use as part of a pavement structure.

Summary

Waste materials can be recycled to produce valuable construction materials for pavements. Many different types of waste materials have been and are currently being used in this application. The challenge is to recognize potential uses of the various waste materials and to apply engineering solutions for their use in pavement construction. Specifications that are developed should address the environmental aspects of using particular wastes.

The availability and generation of waste materials is not constant. While some materials will cease to be produced, new ones will appear. The satisfactory use of larger volumes of these and other types of waste materials through proper design and construction procedures can provide enormous economic and environmental benefits.

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Sets, Kits, and Outfits:

Technical Trades and Topography

By Alan Schlie

In the final of four articles on sets, kits, and outfits (SKO), the focus is on the technical trades and topography. The first article discussed tool sets for construction trades; the second concentrated on pioneering, mine warfare, and demolition tools; and the third addressed bridging, diving, lighting, and fire-fighting tool sets.

General Engineering

The **Field Sketching Set, T63238,** is a collection of pencils, protractors, drafting scales, paper, and erasers in a box, with a small drawing board mounted on a collapsible, wooden tripod. The set's most technological component is a solar-powered calculator. With the advent of Land Warrior, the need for this set in combat units is limited; but in units that cannot expect to receive Land Warrior, some type of field-sketching capability is a must. The set is being completed revised and is awaiting software-integration funding. The set will contain a belt-wearable computer with pen tablet; laser range finders with digital compass and vertical angle capability; a digital recording device; and numerous software applications for surveying, drafting, earthwork estimation, and construction planning.

A soldier uses the Field Sketching Set to digitally record and display the geographic positions of objects.

The **Drafting Set: Battalion Charts, G44569,** contains both the older, manual drafting implements and a newer computer-aided design (CAD) capability. Next scheduled for review in 2003, this set is critical to commanders' construction-planning capability. Supporting the drafting set is the **Reproduction Set: Diazo Process, R84689,** which provides a capability to produce engineering drawings and prints in the field. The Diazo process requires an ammonia-based chemical, which complicates its use within enclosed areas and makes cleanup in the field difficult. Newer, multiple-scale engineering copiers are available commercially and have other advantages in addition to their environmentally friendly toners and developers. The next generation of engineering plotters will be digital, full-color, multiple-scale, and scanner-capable. The reproduction set is being reviewed at this time.

Material test sets include the **Concrete Test Set, V71587,** used to test aggregates and concrete; **Asphalt Test Set, V64463,** used to test aggregates, asphalt materials, and asphalt paving; and **Soil Test Set, V92959,** used to determine soil trafficability, compression, or foundation stress. With a few exceptions, the components of the three sets reflect equipment used in high school science labs in the 1960s. All are being reviewed this year and will include moderate upgrades in technology. The future intent is to collocate these three sets, the drafting set, and the reproduction set in an expandable military shelter to create a true job-site planning and materials-testing lab.

General-Purpose Surveying Set, U70179, is used by soldiers to conduct surveys essential to road, airfield, building, and utility construction. A three-soldier surveying team collects point data in the field using the automated integrated survey instrument (AISI). The data is downloaded and manipulated by Terramodel software and provides the products necessary for construction planning, designing, and estimating. The set, which is capable of producing third-order surveys, was reviewed in 1999.

Maintenance

Most of us refer to it as the "contact truck," but it is actually the **Contact Maintenance Shop Equipment Set: Truck-Mounted**. Your unit may have the M880 truck-mounted set, T10138; or the commercial utility cargo vehicle (CUCV)-mounted set, S30914; or the latest version on a high-mobility, multipurpose wheeled-vehicle (HMMWV) chassis, S25681. Each set provides organizational and direct-support maintenance teams an on-site repair capability for engineer equipment. The sets contain oxyacetylene and arc-welding equipment, power tools, diagnostic equipment, and hand tools. The older models carried portable generators for the electric-welding capability. The HMMWV model's power requirements are met internally with 200-amp electric arc-welding capability and 4-kilowatt, 120-volt, 60-cycle, alternating-current power for tools. The Ordnance School is fielding the HMMWV-mounted set. The M880 and CUCV-mounted sets are no longer being fielded and are scheduled for review this year.

We call this one "the Batmobile," but in reality it is the **Organizational Repair Shop Equipment Set: Light-Truck-Mounted, T13152,** when mounted on a truck or the **General-Purpose Repair Shop Equipment Set, T10549,** when mounted on a semitrailer. The model of the truck may change, or it may be mounted on a semitrailer, but the on-board tools include an air compressor, lathe, battery charger, drills, welding machine, and hand tools to support organizational maintenance and direct-support maintenance of engineer equipment. Power is provided through a power takeoff or external 240-volt AC power source. The dynamotor engine for the welder connects to the truck engine or, on the semitrailer version, to the on-board generator. A machinist, a specialty MOS trained by the Ordnance School, operates both systems. The sets are being reviewed at this time.

Precision Instrument Repair Tool Kit, W4930, is designed to be used by soldiers tasked to repair surveying instruments. However, with the fielding of AISI, surveyors are not required to perform other than operator-level maintenance on the instruments. This set will be declared obsolete in the future.

Hydraulic Systems Test and Repair Unit (HYSTRU), T30377, is a trailer-mounted shop set containing maintenance tools and test equipment for diagnosing, maintaining, and repairing hydraulic systems. The operator can fabricate hose and tube assemblies, measure pressure, flush and clean hydraulic fluids, and transfer fluid. It will be reviewed in 2003 with the intent to mount it along with the contact maintenance truck on the chassis of one of the family of medium tactical vehicles (FMTVs).

Pipeline

Until the decision is made on whether the Army will use only aluminum pipeline and speed couplings for distribution of water and petroleum, oil, and lubricants, the need remains to repair existing pipelines regardless of construction material. Those sets include the **Pipeline Welding Radiographic Inspection Equipment Set, N95306**; the **Pipe-Cutting and Grooving Tool Set: 6-, 8-, 10-, and 12-inch Pipe, W48485**; the *Pipeline Construction Tool Kit: Welders Supplemental, W56910;* the *Pipeline Construction Tool Kit: Grooved Coupling, W48896;* the *Supplemental Pipeline Pumping Station Tool Kit: 4-, 6-, and 8-inch Pipe, W65884; and the Welded Pipeline Construction Tool Kit: 4-, 6-, and 8-inch Pipe, W58006.* Two storage-tank erection sets used in conjunction with pipeline construction (*Erection Outfit: Low Bolted Storage Tank, H14389;* and *Erection Outfit: High Bolted Storage Tank, H14252),* that may remain in the inventory for some time to come. These SKO, which are located in engineer pipeline companies and quartermaster petroleum-pipeline and terminal-operating companies, are scheduled for review in 2001.

Aggregate Production

The ongoing fielding of the 125-tons-per-hour **Crushing, Screening, and Washing Plant, F49673,** will allow quarry units to produce quality 3/8- to 4-inch aggregate for construction projects. The plant replaces all crushing, screening, and washing equipment. The plant consists of 20 pieces of major equipment that require 375 kilowatts of electrical power to operate and meets Environmental Protection Agency dust-abatement and noise standards. When the Hydraulic Excavator II (HYEX-II) is fielded beginning this year, it will replace the current *Rock-Drilling Equipment, S03225*; and the *Pneumatic Tool Outfits*, (600-cubic-feet-per-minute), *P12140. The Pneumatic Tool Compressor Outfit*: (250-cubic-feet-per-minute), *P11866*, will be retained in many units and will be joined by the *Hydraulic Electric Tool Outfit (HETO), W58486,* to provide multiple power sources for hand tools.

Railroad

Two engineer SKO support the principal tasks of the Transportation Corps Railroad Battalion. The Railway Engineer Company contains two platoons of carpenters tasked to lay and repair track and construct railroad bridges, structures, and facilities with the **Railway Construction Set:**

Soldiers from the 249th Engineer Battalion (Prime Power) unload a 750-kilowatt, lightweight generator.

Railroad Track; R05441. And the Railway Equipment Maintenance Sections repair rolling stock with the **Railway Equipment Maintenance Tool Set; W63281**. The next scheduled review for these SKO is 2003.

Prime Power

At a recent conference, prime-power subject-matter experts conducted a comprehensive review of the SKO supporting their missions. The battalion's mission is to provide up to 18 megawatts of electrical power for facilities such as command-and-control sites, hospitals, weapon systems, and logistic-support areas. The power plant operation and maintenance teams rely on the *Power Plant Service Kit, S78722,* to establish, operate, and maintain power plants. Power-line teams construct and maintain up to 60 miles of high-voltage transmission line. To complete their mission, they use the *Power-Line Maintenance Service Kit: Transmission-Line Power-Line Team, S78712,* and the **Electrical Power Transmission Tool Set: Railway Maintenance, W60952**. The *Power-Line Maintenance Service Kit: Distribution-Line Utilities Team, S78702,* is used for construction and maintenance of lines between transmission lines and buildings and structures. These SKO will be reviewed in 2002.

Topographic

The **Topographic Section Surveying Set, U71275,** provides surveying, drafting, computing, and office equipment for use in preparing sketches, drawings, and maps and furnishing geodetic control to the field artillery. The most recent supply catalog combined this set and the **Topographic Platoon Surveying Set: Supplemental, U71138**. The set was reviewed in 1999; the next review will consider consolidating the construction surveying set and drafting set with this set.

Transportable Lightweight Printing Plant: Special Warfare, P61665, is used by psychological operations (PSYOPS) teams to create, photolithograph, and print pamphlets, leaflets, and posters. Mounted on two trucks towing 15-kilowatt generators, it is capable of printing 8,000 single-color, 11- by 17-inch products per hour. It is now one of three modules developed for the PSYOPS Modular Print System. Proponency will be transferred to the Special Warfare School.

The **Topographic Support System (TSS)** consists of 22 separate sets, each mounted on a semitrailer. It successfully mobilized what had been an immobile plant operation for creating, updating, and printing maps and other terrain-analysis products. The TSS has done a yeoman's job since initial fielding in 1987, but it reflected the technology of the 70s when it was developed. Some of the sets are already being turned in, but a few will be retained to meet specific contingencies, such as map production.

The **Digital Topographic Support System (DTSS)** will provide timely and accurate digital and hard-copy geospatial information to meet commander and staff real-time requirements for topographic support. The DTSS supports the collection, extraction, and exploitation of the physical characteristics of the surface of the earth in order to build a foundation for the common knowledge of the battlespace. The DTSS provides the commander with tools to enhance battle-management capabilities. The benefit is that the commander's situational awareness of the battlespace is visualized as never before.

The DTSS consists of four configurations to provide specific products at different command levels on the battlefield. The *DTSS-Light* provides digital equipment to respond rapidly to the commander's need for topographic products and to quickly process low-volume reproduction of large-format, high-resolution, multicolor topographic products. The *DTSS-Deployable* was previously known as the MultiSpectral Image Processor (MSIP). It manipulates digital terrain data and provides it to commanders to support tactical decisions. The *DTSS-Heavy* consists of a larger mix of equipment to support more workstations. The *DTSS-Base*, also called the Terrain Imagery Integration Prototype (TIIP) provides equipment enabling the echelon-above-corps topographic unit to respond to the commander in chief's requirement for generating terrain data, analysis, and production of graphics, maps, views, and other products. Basis of issue plans have been completed, and fielding of the various systems is underway. Although DTSS are issued in set configuration, they are not true SKO in that reviews and supply catalogs will not follow SKO procedures.

Miscellaneous

Engineers are proponents for some unique SKO. Fire stations are tasked to repair the hoses and refill/recharge carbon dioxide fire extinguishers. This is accomplished using the *Repair and Refilling Kit: Carbon Dioxide Extinguisher, R72484*. In circumstances where deployment is likely to an area where native timber can be harvested for theater-of-operation construction, a **Supplementary Equipment Set: Forestry, U59373,** provides pioneer hand tools to support the forestry team's 60-inch-diameter sawmill. (Numerous combat-engineer battalions were operating sawmills in the Ardennes when called on to contain the German offensive, referred to as the Battle of the Bulge, in the winter of 1944.) The *Tool Kit Rigging Wire Rope: Cutting, Clamping, and Splicing, W50266,* is found wherever wire rope or cable is used on winches, anchorages, or slings. It contains the items necessary to cut, clamp, or splice 3/8-, 1/2-, and 5/8-inch-diameter wire rope. Soldiers involved in driving piles use the **Portable Jetting Set: Pile-Driving Operation, L16026,** to aid in the final positioning and aligning of piles before they are capped for work platforms, or bents, or as posts for retaining walls, dikes, levees, breakwaters, abutments, or footings. The *Sign-Making Kit, S70984,* is found in every unit with a need to provide information, instruction, or directional signs. The oddest set in the engineer arsenal of soldier tools is the **Amphibious Lighter Tool Set: LARC V Organizational Maintenance, W31223**. No longer an engineer responsibility, it is at the top of the make-it-obsolete list.

Comments

The Tool Improvement Program Suggestion (TIPS) has been combined with the Supply Maintenance Assessment and Review Team (SMART) suggestion program. TIPS still focuses on tools, while SMART focuses on organizations and processes. Use TIPS to report tools that should be deleted from the system, added to the system, can't stand up to use, or need to be modified to work better. Both programs provide monetary awards in many instances. Put your SMART ideas on a DA Form 5533 and TIPS on DA Form 2233, or on plain paper, and send them to Project SMART/TIPS, Director of Combat Developments for Combat Service Support, 3901 A Avenue, Suite 220, Fort Lee, Virginia 23801-1809. You can also call DSN 687-0363/2406/2399 or e-mail *SMART@lee.army.mil*. The web site is *http://www.cascom.army.mil/multi/project_smart/*.

Comments on tools within engineer SKO can also be addressed to the Directorate of Combat Developments, Engineer Division, ATTN: ATZT-CDE-O, 320 Engineer Loop, Suite 141, Fort Leonard Wood, Missouri 65473-8929. Telephone numbers are DSN 676-6191 or commercial (573) 563-6191. You can also e-mail your comments to *schliea@wood.army.mil* or the web site at *http://www.wood.army.mil/WebCommentForm.htm.* We don't give monetary awards, but there is a faster response.

The Army is always looking for better, faster, cheaper, and safer ways of doing business, whether it's supply, maintenance, transportation, or engineers.

Summary

This final article of the series gives a glimpse of the magnitude and diversity of the SKO managed by the Engineer School. And it hints at the impact SKO have on the battlefield as each soldier's tools of the trade, the absence of which would result in less mission accomplishment. As the four articles have discussed, considerable effort is being expended to update engineer tool sets. Much work still remains if we are to provide the right tools for the job. Unit commanders have been given the task of obtaining these tools within the constraints of operating budgets. There is no requirement for a unit to have all the newly configured sets immediately. The intent was to neither cause readiness problems nor break the piggy bank but to provide tools for soldiers to accomplish their designated tasks quickly, professionally, and with pride.

Mr. Schlie is a force development analyst with the Directorate of Combat Developments, U.S. Army Engineer School. A retired command sergeant major, he has served in various capacities in Europe, Korea, and CONUS throughout his career.

GIS – The Bridge Into the Twenty-First Century

By Lieutenant Colonel Tim Rensema, Mr. Craig Erickson, and Captain Steve Herda

> *"Terrain visualization is the responsibility of commanders and staffs across the spectrum of today's Army. To effectively see the impact that terrain has on units conducting and supporting military operations, all commanders and staffs must be aware of the effects of terrain. The terrain expert is the engineer."*
>
> *Major General Robert B. Flowers*
> *Commandant, U.S. Army Engineer School*

It is the responsibility of engineers to advise leaders of the effects that terrain may have on unit operations. The U.S. Army Engineer School offers valuable training in understanding these effects and the tools that are available to analyze terrain. Among these tools is the PC-based TerraBase II, version 3, which performs terrain-evaluation functions such as line-of-sight displays, weapons fans, slopes, oblique and perspective views, fly-throughs, sunlight/moonlight data, and distance measurements. Army topographic units have the Digital Topographic Support System (DTSS). Engineer terrain-analysis teams (military occupational specialty 81T) use the DTSS to provide Geospatial Information and Services (GIS) support. The terrain teams are the critical support element for terrain complex analysis in support of the military decision-making process (MDMP). The terrain teams are currently allocated down to each division in the Army. In the digital force, the DTSS has a much-expanded role that includes digital terrain data management and dissemination. In the expanded role, terrain teams and equipment are allocated to each maneuver brigade.

High-end GIS tools like the DTSS combine remotely sensed data, conventional ground surveys, and cartography on various computer-based systems. The Army's GIS, which continues to evolve, relates real-world positional data from the battlefield to positions on a known grid reference so that attributes such as slope, vegetation, and bridge capacity may be analyzed. The GIS databases can be accessed, manipulated, and transformed in an interactive process that allows commanders, decision makers, and planners to explore the battlefield and obtain the range of consequences of a plan before mistakes are irrevocably made.

For the majority of units in the Army Reserve Component, access to the benefits of GIS may seem out of reach. However, this capability to move from acetate and grease pencils to a computer-maintained, digital spatial-management system is within our grasp today.

Advantages

The potential advantages of the GIS go beyond just viewing terrain information. By using spatial data from a variety of sources, GIS programs can reduce analysis time, simplify complex decisions, and reduce the time on the objective for reconnaissance teams. GIS data layers afford additional functionality in expediting various decision matrixes required by staff elements. As an example, these programs could support obstacle-plan development, route reconnaissance, force protection, and other tactical operations.

Another benefit of the GIS is its ability to evaluate all available data (including elevation), which increases the potential to provide spatial decision criterion to commanders. Additional data can be incorporated into the GIS database to allow more accurate analysis at tactical operations centers.

Integrating administrative data layers with the tactical requirements of maneuver commanders is a concept worth testing. The Integrated Training Area Management (ITAM) program has already established an experienced operator base with the equipment to apply GIS to environmental, facility, and training-site management. Most installations already have ArcView© to analyze data layers for their training areas. Through ITAM, active and reserve installations can provide spatial-analysis systems to maneuver commanders wanting to expand their battlefield-analysis capabilities.

Testing the System

The Minnesota Army National Guard at Camp Ripley has one of the most advanced GIS databases in the Army National Guard. Personnel there have created more than 75 data layers to better support training-site personnel. During its 1999 annual training at Camp Ripley, the 164th Engineer Battalion (C)(M) from Minot, North Dakota, used a Mississippi River crossing operation conducted by its 957th Engineer Company (Assault Float Bridge) from Bismarck, North Dakota, to develop and test the concept of using administrative GIS data layers to support tactical operations. Camp Ripley's hardware, software, and personnel were used to develop this exercise. Using Field Manual (FM) 90-13, *River-Crossing Operations*, as a reference, battalion personnel identified data necessary to determine the best crossing sites.

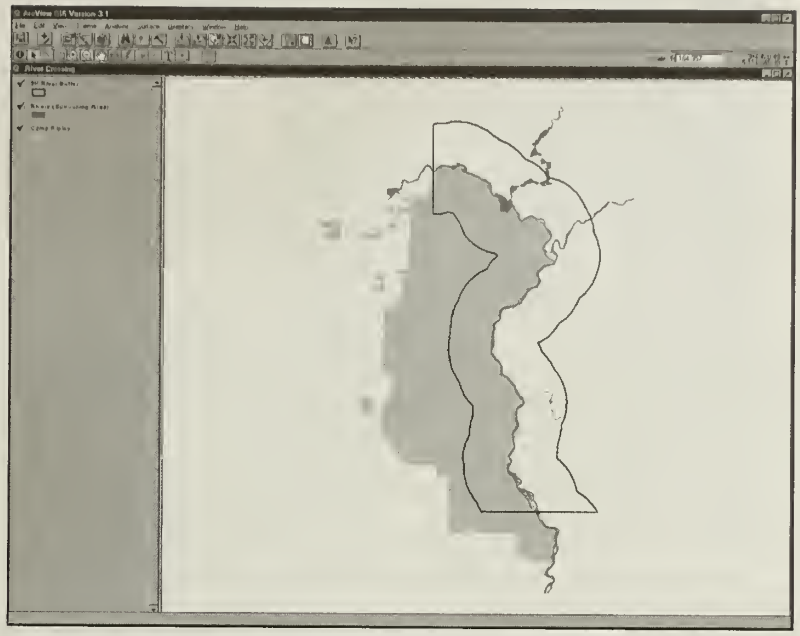


Figure 1. The corridor outlined in black depicts the area considered for river-crossing site analysis; this area is a 3-kilometer buffer of the main river channels adjacent to Camp Riley training lands.

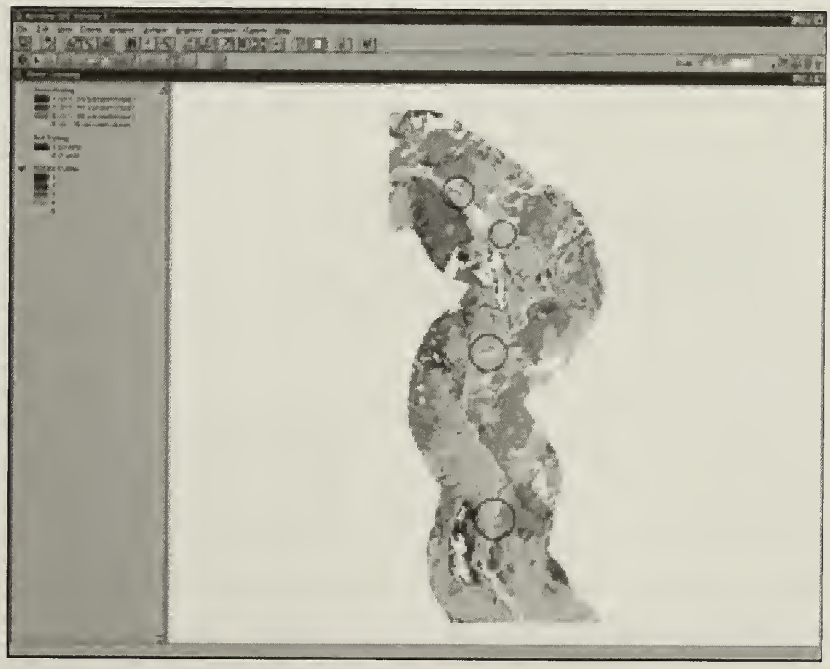


Figure 2: This terrain-rating layer, created from slope and soil-texture data, was used to evaluate the area along the entrance and exit banks that met slope and soil requirements. The circled areas were considered potential crossing sites.

Pertinent evaluation information for river crossings includes slopes, soil types, river width and depth, current velocity, vegetation cover, obstacles, and the enemy situation.

Working with the Minnesota Army National Guard GIS staff, 164th personnel reviewed existing data layers to determine the support data that was available for developing a river-crossing scenario, using the analytical ArcView© capabilities with the spatial-analyst extension. We found that most of the evaluation information needed was available within existing data layers obtained through remote sensing. While the capability to determine water depth and current velocity is currently not available, software is constantly being improved to obtain these variables based on factors such as drainage basins, slope, and discharge of the river.

Figure 1 shows a layout for the river-crossing exercise that was produced by using the GIS. It depicts the corridor considered for river-crossing site analysis—a 3-kilometer buffer of the main river channel adjacent to Camp Ripley training sites. This buffer defines the area to which analysis programs will be limited. While the entire area could undergo analysis, this buffer area reduces analysis time and represents all possible crossing sites.

The second analysis phase involved developing crossing-site evaluation criterion. We applied a suitability analysis method that combined slope, taken from a digital elevation model (DEM), and soil texture data to evaluate areas along the entrance and exit banks that met FM 90-13 requirements. Figure 2 shows the terrain-rating layer, the resultant data layer of this analysis.

From the terrain-rating data layer, the best river-crossing sites were visually identified. Other potential analysis requirements for site selection were identified also, such as river width, road networks, cover and concealment, and salients in the river course.

River width was taken from satellite data provided by the National Imagery Mapping Agency. Road networks, which define how well a site can support a maneuver-unit crossing, and cover and crossing area. Figure 3, page 36, depicts the area of operation and captures all of this data, with the exception of the weather, and identifies what we determined to be the best river-crossing site. Analyzing data layers using the GIS may never completely replace the need for ground reconnaissance, but it can reduce the time spent at the site.

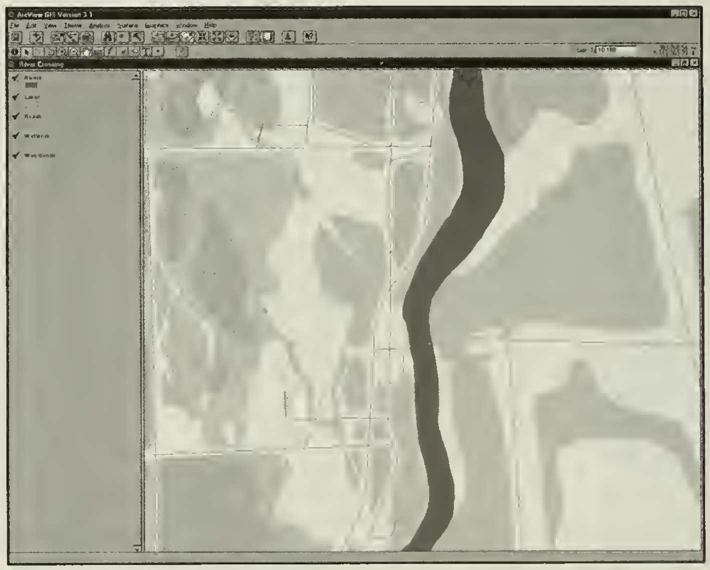


Figure 3. Road networks, lakes, rivers, wetlands, and woodlands were used to individually evaluate potential crossing sites. This is a close-up view of the southernmost potential crossing site.

Other helpful information used in determining risks was obtained through DEMs. This included line-of-site analysis, which enabled us to determine where the bridge site was exposed to enemy direct fire and to identify enemy positions in defilade on the opposite shore. Once enemy emplacements of artillery and mortar were known, the artillery range could be overlaid on the project location using the GIS program. We used this tool to determine whether our crossing site came under indirect fire from known enemy divisional and regimental artillery groups. Our selected site was out of the effective range of the regimental artillery group but within the divisional artillery group range. Our friendly fire support also could have been included as a data layer to determine the direct- and indirect-fire-support coverage we could expect.

Especially crucial to the success of this test was having the proper requirements in place, such as a well-defined operational scope, appropriate hardware and software, a GIS-competent operator, and a resident database.

Conclusion

The Deputy Chief of Staff for Operations has organized regional support centers to provide a consistent database for training-site management. It contains "core" data layers that are also conducive to tactical operations. With the addition of layers and modifications provided by analyses of other units, many different tactical scenarios can be "played" using existing GIS operations. TerraBase II provides terrain-evaluation tools based on elevation data, digital imagery data, and digital map data. For more complex analysis requirements, an interactive GIS program like ArcView© can help maneuver commanders benefit from GIS even if the DTSS has not been fielded to their units.

Lieutenant Colonel Rensema is a War College Fellow at the Army Environmental Policy Institute in Atlanta, Georgia. He previously commanded the 164th Engineer Battalion (C)(M), Minot, North Dakota.

Mr. Erickson is the GIS Specialist at the Camp Ripley Training Site Environmental Office, Little Falls, Minnesota.

Captain Herda commands the 957th AFB Company, Bismarck, North Dakota. He previously was the plans officer for the 164th Engineer Battalion (C)(M).

(continued from page 17)

1943, the peak year of training at Fort Leonard Wood. The interior of one of each type of building has been restored. Also, the interior of one barracks building has been restored to interpret basic training barracks in 1967. This Cold War interpretation dramatically illustrates the adaptive reuse of World War II temporary buildings to support the training boom of the Vietnam conflict.

Other restored buildings in the complex house a variety of exhibits supporting the history of Fort Leonard Wood. One restored dayroom has a display dealing with the life and career of MG Leonard Wood, the installation's namesake. In another restored barracks is an interpretation of the German and Italian prisoner-of-war camp, which operated at Fort Leonard Wood from 1943 to 1946. The most recent addition to this area is a historic chapel. By preserving this collection of World War II buildings, Fort Leonard Wood has created a time capsule of the history of the training experience from 1941 to the present.

Regimental Store

Located in the lobby of the museum, the Regimental Store (which is operated by the Army Engineer Association) offers a unique line of gifts. Merchandise primarily features engineer regimental crests and the engineer castle. Proceeds from the store help support the adjacent engineer Regimental Room. Steeped in engineer history, the Regimental Room proudly displays colors and special plaques of deactivated engineer units.

Come and visit your Engineer Museum.

Mr. Combs is the Engineer Museum curator.

Located at the corner of South Dakota and Nebraska Avenues, the museum is open to the public, free of charge, from 1000 to 1600, Monday through Saturday. The telephone number is (573) 596-0780 (DSN 581-0780), the e-mail address is combsk@wood.army.mil, and the web site is www.wood.army.mil/museum.

A Genius for Fortification:

Vauban and the Future of Positional Warfare

By Dr. Burton Wright III

Today positional warfare is a long-forgotten art. Armies of the future will never allow themselves to become bogged down in reducing fortresses or, for that matter, in building them. Such anachronisms can be bypassed by vertical envelopment or destroyed by precision munitions.[1] Speed and violence of execution are the tenets of today's doctrinal manuals. Picks and shovels belong in museums. Or do they?

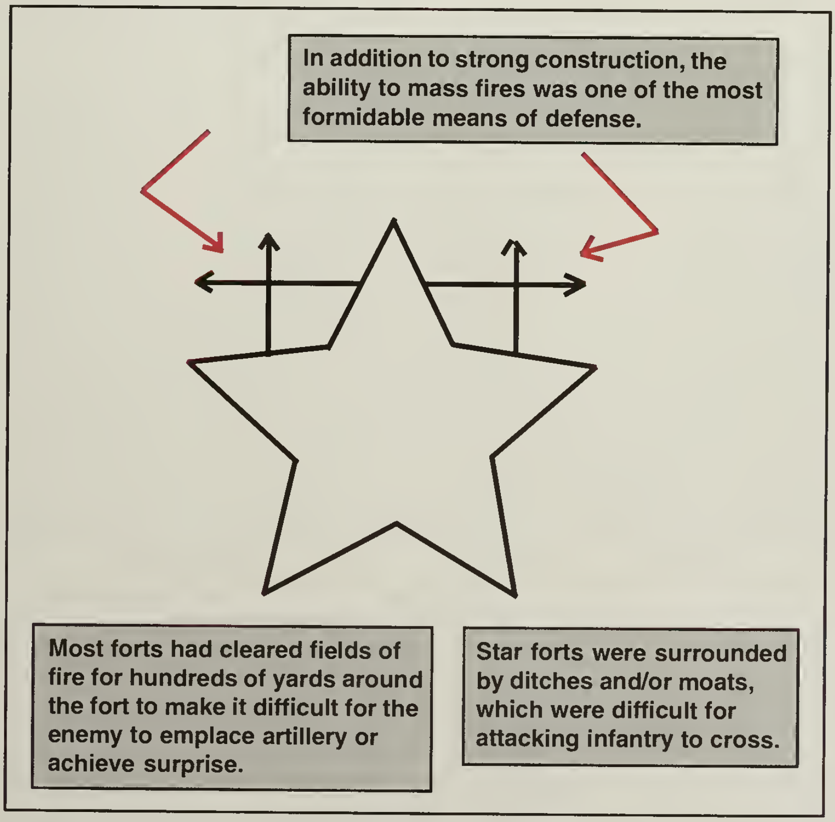
When he became king, France's Louis XIV joined with Inspector General Jacques Martinet[2] and the Minister of War, the Marquis de Louvois, to create an excellent standing army of 200,000 men.[3] Although it was the best-drilled and best-equipped in Europe, in the long series of dynastic wars that followed, Louis' army became very adept at maneuver and fortifications. This expertise was the result of the genius of one man—an engineer named Sebastian le Prestre de Vauban.

Born of poor landowners, Vauban was orphaned in childhood and brought up by peasants. He retained many aspects of their culture throughout his life. At the age of 17, he enlisted as a private soldier and was eventually commissioned a lieutenant. His talents were so outstanding that he attracted the attention of the Marquis de Louvois, who did not let the lack of blue blood stand in the way of promoting good men.[4] Through his brilliance and professionalism, Vauban worked his way up to the rank of Marshal of France. Over four decades, this engineer compiled a series of spectacular victories—in both attacking massive forts and in defending them from attack—that has never been matched.

Before Vauban's time, fortifications were somewhat primitive and consisted of high walls protected by a moat or ditch. In the Middle Ages, simple linear walls of stone were enough to keep those inside safe and sound. But with the invention of the cannon, the idea of fortifications took a new turn. Walls became massive and impervious to direct infantry assault. Engineers of Louis XIV's day went even further in developing defensive positions, making it much more difficult to conquer a city in a short time. Sieges became long and bloody affairs.[5]

France's principal enemies during Louis XIV's reign were the English and the Dutch. Both provided formidable opposition to the king's dynastic plans for Europe. Most of the major fighting during his numerous conflicts with his neighbors took place in and around Belgium and the Netherlands. Both nations have terrain that is more adaptable to the use of fortifications to deny an invader entrance than to maneuver warfare.[6] It was for this type of war that Vauban was most suited.

One of Vauban's defensive techniques was to build forts in the shape of a star and place them on critical terrain in advance of the main walls of the city (see Figure 1). This forced an enemy to reduce the fort before taking on the city. The star shape allowed the garrison to use



In addition to strong construction, the ability to mass fires was one of the most formidable means of defense.

Most forts had cleared fields of fire for hundreds of yards around the fort to make it difficult for the enemy to emplace artillery or achieve surprise.

Star forts were surrounded by ditches and/or moats, which were difficult for attacking infantry to cross.

Figure 1. A star-shaped fort.

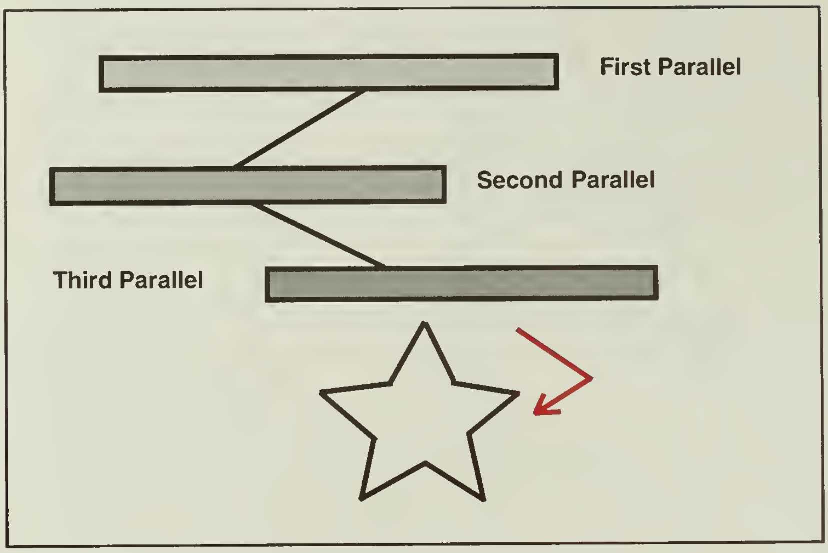


Figure 2. The parallel method of attack.

flanking fire and to sweep the glacis of attacking infantry. The defenders' cannons were placed in embrasures to give them protection while they fired. Star-shaped forts had both inner and outer defenses; if one was breached, then the other provided safety for the garrison to continue the resistance. (*Note: If you fly over many of the border towns of France, Holland, and Belgium, you can see numerous intact examples of star-shaped forts. Most of these were built and designed by Vauban.*) [7]

During the Middle Ages, one of the ways to breach fortifications was to dig a sap or tunnel (hence the term *sappers*) under a wall and explode gunpowder in the tunnel so the wall would collapse. Many of Vauban's forts were constructed so that this breaching method would not collapse the walls. He used large amounts of packed earth combined with masonry and stones to create a powerful line of fortifications. The only way to attack with some expectation of success was to use a parallel method that Vauban pioneered.

Vauban's parallel method of breaching consisted of parallel lines dug at right angles to a line of fortifications and then turned at right angles, much like a zigzag design (see Figure 2). Gibbons (round, dirt, protective rolls, often enclosed by woven rope or straw) were pushed in front of those digging the parallel. When the parallels were close enough to the fort, guns were situated so as to put that part of the fort under fire, then the second parallel was begun. At the end of the second parallel, more powerful and shorter-range guns were placed to support the third parallel. This brought the infantry near the walls, which allowed a direct attack. This system could take weeks or even months to accomplish, because usually more than one parallel was planned against a fort.

Vauban made his reputation at the age of 40 with the siege of the great Dutch fortress town of Maestricht, where he first used his parallel system of attack. When his parallels reached below the wall of Maestricht, Vauban approached the commander of the city and requested that he surrender. The commander refused, so the French army set off mines and other explosions to create lanes through which infantry overwhelmed the defenders.

In Holland, where much of Louis XIV's Thirty Years' War took place, roads were few and in terrible condition, so canals and rivers served as logistical lifelines. Possessing fortified areas along one of the critical canals could mean the difference between defeat and victory. Year after year, France fought England and Holland for these important fortified towns and the strategical control they offered. The capture of Maestricht allowed the French to use the inner waterways of Holland for moving troops and supplies. Several months later, Vauban successfully forced the surrender of Trier. This gained for France the control of the Moselle River and enabled the country to supply one of her greatest generals, Turenne, while he campaigned in Germany.

Toward the end of several great battles between the French army and the army of the Duke of Marlborough, the French built a series of fortified lines in Belgium that was too strong to directly attack. Vauban's genius helped to fashion those lines, and they were never penetrated to any extent. The French army, under the aged but crafty Marshal Villars, was able to use the lines as an area to retreat to when pressed by the British and Dutch forces. The army rarely ventured beyond these lines.

Defensive warfare can help preserve an army from disaster when time is the most important factor. The French knew that eventually both the Dutch and British would tire of the war and seek a negotiated peace. Queen Anne dismissed Marlborough and, after a few small battles (the last of which was Demain), the war ended. The Peace of Utrecht followed.

Without the genius and professional skill of Vauban, many of Louis XIV's campaigns in his various wars to make France the strongest country in Europe would have come to naught. As long as Vauban was alive, France was assured that he and his engineers would dominate the war of fortresses.

Who knows, a future Vauban may be serving in our Army right now? Since terrain dictates tactics, if the enemy chooses to use dominant terrain, then we can be sure that fortifications of some kind will be built and, more importantly, have to be breached.

For example, during World War II in Italy, Field Marshal Albert Kesselring conducted a masterful defensive battle up the Italian boot by fortifying dominant terrain and annihilating the Allies as they attempted to take it. And during the long, bloody battle to take the dominant heights of Monte Cassino, the British, American, and Polish armies were all forced back. Finally, the Polish army broke through, but the cost in casualties was enormous.

In Vietnam in 1967, the U.S. Army's 173d Airborne Brigade faced dug-in and fortified North Vietnamese forces at Dak To. Before the battle began, U.S. soldiers found communications wire and steps cut into the hillside, which told them the enemy's level of preparation. The soldiers knew the North Vietnamese waited in deep, camouflaged bunkers. The 173d had not moved even 50 yards up the hill when they became involved in heavy combat.

It is still possible, given the terrain in which the U.S. Army might have to fight, that we may face enemy fortifications that even Vauban would find formidable. Since it is engineers who must help neutralize them, we can only hope that there will be a Vauban in the engineer ranks. Believe it or not, positional warfare still has a future. Don't throw away your pick and shovel. You may need them!

Dr. Wright is the Chemical Corps historian at Fort Leonard Wood.

Endnotes:

[1] Clearly from experience during the Gulf War, precision munitions are very useful against specific types of fortifications and bunkers. However, the Iraqi forces underground, where fortifications were not readily visibile, were not damaged significantly by these attacks. Robert H. Scales. *Certain Victory: The U.S. Army in the Gulf War.* London: Brassey's Inc, 1998.

[2] The term "martinent" comes from this man. His training of the new army was exact, and French units moved with an almost straight line. Discipline was severe. Many of Frederick's soldiers were trained under this system. Lynn Montross. *War Through the Ages.* New York: Harper and Brothers, 1955.

[3] What made this Army so unique was it was a "standing army." Most of the armies of the period were not as large and usually were the king's or emperor's personal guard. Soldiers were formed only when needed. They also wore specific uniforms for specific duties as Gustavus Adolphus had pioneered with his Swedish Army. Archer Jones. *The Western Way of War.* New York: Penguin Books, 1985.

[4] The Minister of War was among the first of his type to recognize talent in other than the nobility and to promote soldiers on that basis. Napoleon was soon to follow this example. Many of his best leaders, such as Lannes and Davout, were drawn from the middle class. Alistar Horne. *So Far From Austerlitz.* New York: William Morrow, 1999.

[5] Montross.

[6] For a good understanding of the use of terrain, see David Chandler. *Marlborough as Military Commander.* New York: Charles Scribner's Son, 1973. Pp. 77-92, 151-165.

[7] Montross and Chandler.

The Engineer Writer's Guide

We think engineers take a special pride in their profession, and *Engineer* is always looking for articles from readers who want to share their expertise, experience, and ideas.

If you are a potential contributing writer, here are a few "writer's guide" tips to steer you in the right direction.

Articles may discuss engineer training, operations, doctrine, equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers, that's what we need.

Articles should generally come from contributors with first-hand experience of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words, and text should be double-spaced. Generally, each such page should contain from 200 to 250 words. Manuscripts should be originals or clear copies. Provide a 3 1/2-inch disk in Microsoft Word, Rich Text Format, or ASCII (please indicate word-processing format on disk or cover letter). You also may send articles by e-mail to *bridgess@wood.army.mil.*

Articles containing attributable information or quotations not referenced in the story should carry appropriate endnotes.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint.

Include your full name, rank, current unit, and job title. Also include a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime phone number.

Reviews of books on engineer topics are also welcome.

Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 Engineer Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges or Lynne Sparks, at DSN 676-4104, or commercial (573) 563-4104. We look forward to hearing from you.

Note: Due to the limited space per issue, we will not print articles that have been accepted for publication by other Army professional bulletins.

EOBC AND EOAC UPDATE

By Captain Sam Hudson

In the past several years, the Engineer Officer Basic Course (EOBC) and the Engineer Officer Advanced Course (EOAC) have undergone several changes. Because of these changes, many officers in the field may be unaware of the specific types of skills and the actual depth of knowledge that recent graduates of the EOBC and EOAC possess. This article outlines the EOBC and EOAC programs of instruction and briefly explains recent and proposed changes in the courses.

EOBC

The EOBC provides general instruction on the basics of Army engineering. The 17-week course, which includes two weeks for in-processing and out-processing, is divided into four phases:

- **Common Core.** This three-week phase consists of 120 hours of instruction and covers topics in leadership, military justice, training management, and supply management. Engineer students receive instruction alongside chemical and military police officers in many of the classes.
- **Combat Engineering and Tactics.** This six-week phase consists of 238 hours of instruction, which includes bridging, demolitions, mine warfare, and combined-arms tactics.
- **Battalion Field Training.** This three-week phase consists of 345 hours of instruction and includes land navigation, Sapper Stakes, a four-day situational training exercise (STX), and a five-day field training exercise (FTX).
- **Construction Engineering.** This three-week phase consists of 120 hours of instruction, which covers both horizontal and vertical construction.

Focusing more on the "hands-on" application of the students' newly learned skills, only 37 percent of the total course comes in the form of classroom instruction. The remaining 63 percent is practical exercises (PE), the STX, and the FTX. In addition, a basic two-hour offensive/defensive computer exercise (CPX) allows students to integrate their tactical plans into a task-force plan.

Probably the most significant change to the EOBC was the switch from a "tracked" to a "straight-lined" program of instruction in 1997. Until then, students received two weeks of specialized instruction based on their follow-on assignment (such as combat engineering and tactics for combat engineers vs construction training for combat-heavy engineers). Now, instead of specialized training, students receive general instruction in all areas of engineering, regardless of their upcoming assignments. So it is important to realize that none of the students arrive at their first unit with an in-depth knowledge of any one area. To more fully develop their knowledge and skills, new officers must receive guidance, mentoring, and professional development from fellow officers in their new unit.

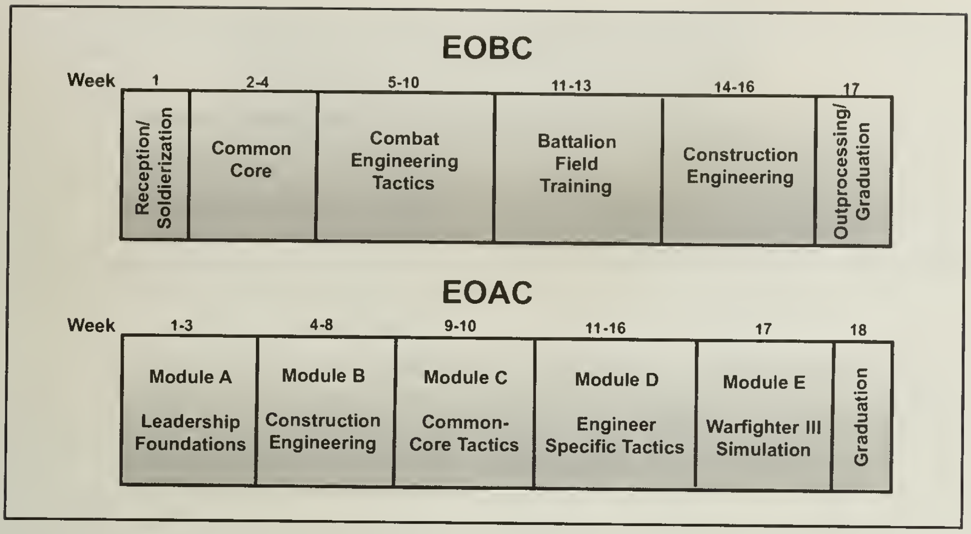
EOAC

Under TRADOC's Captain's Professional Military Education (CPT PME) plan, the EOAC is now considered Phase 1 of the Engineer Captain's Career Course (ECCC) and is primarily designed to prepare engineer captains to command engineer companies and serve as staff officers in combined-arms task forces. While many officers perceived the old 22-week EOAC as a "gentleman's course," this is no longer the case. As of 1999, the course length was reduced to 18 weeks but maintained essentially the same amount of material. Thus, current EOAC students must cover a comparable amount of information in four weeks less than their predecessors.

In an attempt to integrate the branches and services of our armed forces, and to improve cooperation with other countries, a typical EOAC class consists of about 67 percent active-duty engineer officers, 16 percent international students, 8 percent nonengineer officers, 5 percent Reserve Component (RC) officers, and 4 percent Marine Corps officers. Under the CPT PME plan, all active-duty officers (except some who are pursuing advanced degrees) attend the six-week Phase II of the ECCC (the Combined Arms and Services Staff School, or CAS^3) at Fort Leavenworth immediately following completion of EOAC.

EOAC is composed of five modules, with one week devoted to out-processing and graduation:

- **Leadership Foundations.** During this three-week module, students receive instruction on leadership, Army values/ethics, and unit cohesion/team building. In many of the classes, engineer officers are grouped with chemical and military police officers.
- **Construction Engineering.** During this five-week module, students are taught the basics of designing, planning, and procuring materials for construction projects in a theater of operations. The climax of this module is a construction capstone PE using a "real-world" project scenario.
- **Common-Core Tactics.** This two-week module provides the tactical foundation necessary in a combined-arms environment up to the brigade level. Students also develop a company mission-essential task list and plan a company STX.
- **Engineer-Specific Tactics.** This six-week module focuses heavily on the military decision-making process, knowledge of opposing-force equipment and capabilities, intelligence preparation of the battlefield, and the engineer battlefield



EOBC

Week	1	2-4	5-10	11-13	14-16	17
	Reception/ Soldierization	Common Core	Combat Engineering Tactics	Battalion Field Training	Construction Engineering	Outprocessing/ Graduation

EOAC

Week	1-3	4-8	9-10	11-16	17	18
	Module A Leadership Foundations	Module B Construction Engineering	Module C Common-Core Tactics	Module D Engineer Specific Tactics	Module E Warfighter III Simulation	Graduation

assessment. In addition, based on the premise that all engineers are "terrain experts," this module places increased focus on TerraBase II terrain analysis and requesting terrain-visualization and imagery products. Students ultimately apply their newly gained knowledge and skills to produce oral and written engineer-company operation orders (OPORDS) and engineer annexes to task-force/brigade OPORDS for both defensive and offensive operations.

- **Warfighter III Simulation.** During this one-week module, students serve as maneuver and engineer battalion commanders and staff, where they plan both defensive and offensive combined-arms battles using the deliberate military decision-making process. Once the plans are complete, they execute them in two separate CPXs.

The EOAC is structured so that roughly half of the instruction is lectures and discussions. The second half is small-group instruction, with a teacher-to-student ratio of no greater than 1:16. The military decision-making process is continuously emphasized in all aspects of training, and while students are ultimately evaluated on the final products they produce, much attention is paid to the process by which staffs produce their products.

There are several proposed initiatives to increase the quality and relevance of the EOAC program of instruction. For instance, there are plans to better incorporate military operations in urban terrain and stability and support operations into lesson plans. Additionally, there are plans to increase the emphasis on light engineer operations and update the practical exercises to better represent some of the current operational environments. Finally, with rapid increases in technology, future students may cover some course material via distance learning.

In conjunction with the EOAC, selected students have the opportunity to earn a master's degree in engineering management, civil engineering, or environmental engineering from the University of Missouri-Rolla or a master's degree in public policy administration from the University of Missouri-St. Louis. Students concurrently attend night classes during the EOAC, and then immediately attend Phase II of the ECCC (CAS^3) after EOAC. Once ECCC, Phase II, has been completed, students pursuing advanced degrees return to Fort Leonard Wood for various lengths of time to complete their studies, with the exception of students obtaining degrees in civil and environmental engineering. These students finish their degrees before attending ECCC, Phase II.

EOAC-RC and ECCC-RC

The Engineer School divides the EOAC for Reserve Component officers (EOAC-RC) into two phases. These two phases constitute the first half of a four-phase ECCC for Reserve Component officers (ECCC-RC). Phase I consists of 207 hours of correspondence courses and is completed at the officer's home station. Phase II is a two-week resident course at Fort Leonard Wood designed to reinforce the knowledge and skills learned during Phase I through application and PEs. According to the CPT PME, officers must begin Phase II within one year after completing Phase I. During Phase III of the ECCC-RC, officers return to their parent units and conduct annual training. This helps alleviate the possibility of an officer's extended absence from his/her unit. Phase IV of the ECCC-RC is equivalent to Phase II of the ECCC. Students attend either the six-week resident course at Fort Leavenworth or at U.S. Army Reserve schools in their area. Students should complete Phase IV within two years after completing EOAC-RC.

Summary

Both the EOBC and the EOAC will undoubtedly undergo more changes in the upcoming months and years. But with the information contained in this article, officers in the field, especially company and battalion commanders, will have a better understanding of exactly what these new officers have to offer their units.

CPT Hudson is a training developer/writer in the Department of Instruction, Directorate of Training, USAES, Fort Leonard Wood. Previous assignments include company executive officer, B Company, 2d Engineer Battalion, Camp Castle, Korea; and platoon leader, 5th Engineer Battalion, Fort Leonard Wood. CPT Hudson is a graduate of the ECCC. His e-mail address is hudsons@wood.army.mil.

CTC Notes

Battle Command Training Program

Scatterable Minefield Request and Report Procedures

By Major Fred Erst

Combat engineers are increasing their reliance on scatterable mines to shape the battlefield. However, unless corps and division commanders specifically delegate emplacement authority to them, current Army doctrine does not provide brigade and task force commanders the authority to employ scatterable mines as tactical or situational obstacles. Should the corps or division commander withhold scatterable-minefield emplacement authority, existing doctrinal publications do not provide a consistent procedure to request planning or emplacement authority from the authorizing headquarters and do not clearly require units to submit scatterable-minefield warnings (SCATMINWARNs) before emplacing a scatterable minefield. As a result, engineers at corps, division, brigade, and task-force levels often have a wide interpretation of the requirements for requesting and reporting scatterable minefields. A recommended solution to this doctrinal problem is for units to establish procedures that incorporate a report matrix for tracking scatterable-minefield requests, warnings, and records.

Doctrinal Considerations

Current doctrinal publications do not clearly and consistently define scatterable-minefield request and report requirements. FM 5-71-2, *Armored Task Force Engineer Combat Operations, Change 1,* 13 November 1997, includes a situational-obstacle execution matrix but does not specify scatterable-minefield dimensions, planned life cycle, triggers, observers, or purpose as required planning information. FM 20-32, *Mine/Countermine Operation,* 29 May 1998, states that the SCATMINWARN and the scatterable-minefield /munition field report and record (SCATMINREPORT/SCATMINREC) are the only two reports required for use with scatterable minefields or munition fields. The problem is that FM 20-32 combines the 19-line SCATMINREPORT/SCATMINREC work sheet into one document (Figure 8-7, page 8-23) without adequately explaining that it can be used as both a *report of intention* to request emplacement authority and a *record* after a scatterable minefield is emplaced. The format is very effective when it is used as a SCATMINREC. However, when it is used as a report of intention or as a request, the format does not provide authorizing headquarters with the essential planning information to command and control scatterable-minefield employment. This planning information includes triggers, observers, overwatching unit, purpose, and the field-artillery target number if the scatterable minefield is an area denial artillery munitions/remote antiarmor mine system (ADAM-RAAMS).

Additionally, FM 20-32 does not consistently require units to provide a SCATMINWARN before emplacing minefields. Chapter 3, page 3-10, directs that a SCATMINWARN will be sent to all affected units before emplacement. However, Chapter 8, page 8-24, states that a SCATMINWARN can be sent either before or immediately after mines are emplaced. FM 5-34, *Engineer Field Data,* 30 August 1999, describes the same scatterable-minefield request and report requirements as shown in FM 20-32.

A recent publication, FM 101-5-2, *U.S. Army Report and Message Formats,* 29 June 1999, established a new report, the scatterable-minefield request (SCATMINREQ) that is used to request authority to plan emplacement of scatterable mines. However, the SCATMINREQ is not addressed in any current engineer publications. Additionally, the formats for the SCATMINWARN and SCATMINREC specified in FM 101-5-2 are different from the reports outlined in FMs 20-32 and 5-34. While FM 101-5-2 states that the report formats are directive and prescriptive, it also states that branch-specific or technical reports complement the report formats specified in the manual and are not considered superseded by it.

FM 101-5-2 does attempt to establish a procedure for units to request and report scatterable mines in the general instructions of each report. The problem is that FM 101-5-2 does not clearly describe the overall process and does not specifically require units to disseminate a SCATMINWARN to subordinate units before execution. As a result of these differences in Army doctrinal publications, the lack of a clearly defined request and report procedure often compounds the problems that most brigade and task force engineers already have with planning and reporting scatterable minefields.

Brigade Warfighter Exercises

Recent BCTP Brigade Warfighter exercises have shown that many brigade and task force staffs do not adequately plan and synchronize employment of scatterable mines as tactical or situational obstacles during the military decision-making process. During the fight, this often causes brigade and task force engineers to develop and submit additional "911" emergency requests for unplanned scatterable minefields or else to execute scatterable minefields without receiving emplacement authority. Staff engineers often have difficulty complying with scatterable minefield reporting requirements and struggle with tracking the status of SCATMINWARNs and SCATMINRECs. Typically, the result is an increased occurrence of minefield fratricides because of limited situational awareness and a decreased obstacle effect on the enemy's maneuver.

BCTP Procedures

The procedures adopted by BCTP's Operations Group C to manage scatterable-minefield requests and reports during Brigade Warfighter exercises include a three-step process that parallels the doctrinal report flow for conventional minefields found in FM 20-32, Chapter 5. This process uses a standard format for scatterable-minefield requests, which is based in part on the 52d Infantry Division's situational obstacle request form that the Sidewinder Team uses to train brigades at the National Training Center at Fort Irwin, California. This three-step process is also compatible with the standard formats and general instructions for the SCATMINREQ, SCATMINWARN, and SCATMINREC reports outlined in FM 101-5-2. Units can use these procedures when the division plans to withhold emplacement authority for all 4-hour-duration scatterable minefields and the corps withholds emplacement authority for all others. Units can also apply or modify the same procedures to maintain obstacle control when scatterable-minefield emplacement authority has been delegated to subordinate commanders.

These procedures also incorporate a matrix for both the units and authorizing headquarters to track scatterable-minefield requests, warnings, and records to ensure rapid dissemination of essential information (see figure on page 44). Emplacing units use lines 1 through 17 of the matrix to provide the required planning information through their higher headquarters to the authorizing headquarters. Each headquarters uses the last 5 columns (lines 18 through 22) to track the scatterable-minefield request and report process.

Emplacing units (brigades/task forces) use the following three-step process to request scatterable-minefield planning and emplacement authority and to report execution through their higher headquarters (division/brigade) to the authorizing headquarters (corps/division).

Step 1: Submit SCATMINREQ (serves as a *Report of Intention*). When a unit plans to emplace scatterable minefields, it submits a scatterable-minefield request (lines 1 through 17) for planning authority through its higher headquarters to the authorizing headquarters. The SCATMINREQ includes the obstacle number, scatterable-minefield emplacing system, dimensions, grid locations of the corner points, safety zone, type of minefield marking, unit observing/overwatching the minefield with fires, obstacle effect, purpose, life cycle, emplacing unit, triggers, and observers for each scatterable minefield used as a tactical or situational obstacle. If the scatterable minefield is an ADAM-RAAMS, the request also includes the field-artillery target number, aim points, and minefield attitude in mils. The emplacing unit submits the required information through its higher headquarters to the authorizing headquarters. The unit can revise this request or submit an additional request should the plan change during the fight. The G3/S3 of the authorizing headquarters reviews the information to ensure that the planned scatterable minefields do not interfere with future operations and either approves or disapproves the request.

Step 2: Submit SCATMINWARN (serves as a *Report of Initiation*). Before emplacing scatterable minefields, a unit submits a complete SCATMINWARN through its higher headquarters to the authorizing headquarters. The SCATMINWARN informs both headquarters that the unit intends to execute a specific scatterable minefield that was previously approved for planning. The unit may submit a SCATMINWARN anytime after receiving approval but should submit it at least 30 minutes before execution. This technique provides obstacle control to the authorizing headquarters so the commander can rapidly delegate or withhold emplacement authority based on the current situation. It also allows both headquarters sufficient time to further disseminate the SCATMINWARN. The unit then receives authority to emplace a scatterable minefield after the authorizing headquarters acknowledges receipt of the SCATMINWARN. The unit can cancel a SCATMINWARN for any minefield at any time and submit a new SCATMINWARN for other scatterable minefields that have been previously approved for planning.

Before executing the minefield, the emplacing unit should disseminate the SCATMINWARN via FM radio on command nets and operations and intelligence nets to notify subordinate and adjacent units that the area is no longer safe for friendly movement and maneuver. On command nets, the SCATMINWARN should include the obstacle number, type of scatterable minefield, planned life cycle, two 6-digit grid locations, and the safety zone at a minimum. Units should provide a more detailed SCATMINWARN on operations and intelligence nets. FM 101-5-2, Report Number S015, shows the most current format for the SCATMINWARN.

Step 3: Submit SCATMINREC (serves as a *Report of Completion*). This report indicates that the scatterable minefield is complete and functional. After execution, the emplacing unit must submit the SCATMINREC through its higher headquarters to the authorizing headquarters so all units can track self-destruct times and actual locations of scatterable minefields. Refer to Report Number S005 found in FM 101-5-2 for the most current SCATMINREC format.

Planning Information

During BCTP Brigade Warfighter exercises, the division (authorizing headquarters) does not always immediately approve the request for planning authority if the brigade does not submit all of the required information on the SCATMINREQ. Units often have difficulty in defining the scatterable-minefield dimensions, obstacle effect, purpose, trigger, and observer. As a result, brigade and task force engineers should emphasize the following information during the planning process:

Minefield Dimensions. This refers to the length and width of the scatterable minefield in meters (m) rather than the safety zone. For example, ADAM-RAAM, 200 by 200 m, 400 by 400 m, or 200 by 800 m; Ground Volcano, 1,110 by 120 m, 277 by 120 m or 440 by 555 m; Air Volcano, 1,115 by 140 m, 278 by 140 m, or 557 by 440 m; Modular Pack Mine System (MOPMS), 35 by 70 m per dispenser, 280 by 70 m, or 280 by 105 m. The minefield dimensions should also match the six-digit grid locations for the corner points at the start and end of each scatterable minefield.

Obstacle Effect. This refers to the obstacle effect on the enemy (disrupt, fix, turn, or block).

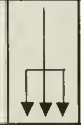
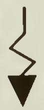
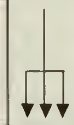
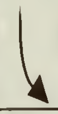
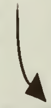
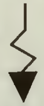
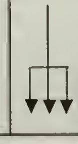
BCTP Brigade Warfighter

Scatterable Minefield Request and Report Matrix

Line 1: DTG of Request 101500NOV00

Line 2: Unit Submitting Request: 1/52d ID (M)

Sheet #______ of ______

Scatterable Minefield Request (Lines 1-17)																		Reports (Lines 18-22)				
Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9-A	Line 9-B	Line 9-C	Line 10	Line 11	Line 12	Line 13-A	Line 13-B	Line 14	Line 16-A	Line 16-B	Line 16-C	Line 18	Line 19	Line 20	Line 21	Line 22
Obstacle Number Target** Number	Scatterable Mine Emplacing System	AT Mines	AP Mines	Minefield Attitude**	Minefield Dimensions	Corner PT Start Grids	Corner PT End Grids	Aim** PT Center Grid	Minefield Safety Zone	Minefield Marking	Unit Observing Minefield	Obstacle Effect	Purpose	Life Cycle	Emplacing Unit	Trigger	Observer	DTG SCATMINREQ Approved	DTG SCATMINWARN Approved	DTG SCATMINWARN Disseminated	DTG Self-Destruct	DTG SCATMINREC Sent to Higher
1001 E1*SF01 AE1001	ADAM-RAAMS Medium Density	Yes	Yes	0 mils	400 x 400 m	NK 505929 NK 505925	NK 509929 NK 509925	NK 550927	1500 x 1500 m	None	TM A 1-121-IN		Isolate OBJ FLA from OBJ TEXAS vic TAI-20	4 hrs	4-118 FA Bn	Eastern CO 3-T80/8-BMP Repositions to West vic NAI-2 (NJ5490)	COLT TM-4 (ALT) COLT TM-2					
1001 E2*SV02	Air Volcano 160 Canisters	Yes	Yes	N/A	1110 x 140 m	NK 500940 NK 500939	NK 511941 NK 511940	N/A	235 m All sides	None	TM D 2-251 IN		Disrupt Enemy CATK vic TAI-25	4 hrs	B/52d Avn Bn	Enemy Res 3-T80/8-BMP CATK vic NAI-6 (NJ5595) Decision PT-3	2-251 Scout TM-1					
1001 B1*SF01 AE2001	ADAM-RAAMS Medium Density	Yes	Yes	800 mils	400 x 400 m	NK 525928 NK 523925	NK 528925 NK 525923	NK 525925	1500 x 1500 m	None	TF 1-121-IN		Separate 1st & 2d Echelons by 30 min vic TAI-22	4 hrs	4-118 FA Bn	Eastern CO 3-T80/8-BMP Repositions to West vic NAI-2 (NJ5490)	COLT TM-4 (ALT) COLT TM-2					
1001 B2ASV01	Ground Volcano 160 Canisters	Yes	Yes	N/A	555 x 440 m	NK 550850 NK 550846	NK 556850 NK 555846	N/A	235 m All sides	4-sided Frat Fence	TM B 2-252 IN		Turn 1st Echelon into EA Viper	48 hrs	A/501st Engr Bn	4-Sided Frat Fence complete. Execute NLT 121400 NOV	N/A					
1001 B2ASV02	Ground Volcano 160 Canisters	Yes	Yes	N/A	555 x 440 m	NK 554844 NK 554840	NK 560844 NK 560840	N/A	235 m All sides	None	TM B 2-252 IN		Turn 1st Echelon into EA Viper	4 hrs	A/501st Engr Bn	Enemy FSE 3-T80/8-BMP crosses PL Bush vic NAI 15 (NJ5400)	2-252 Scout TM-2					
1001 B2BSV01	Ground Volcano 40 Canisters	Yes	Yes	N/A	277 x 120 m	NK 560840 NK 560838	NK 563840 NK 563838	N/A	235 m All sides	None	TM C 2-252 IN		Destroy FSE vic EA Cobra	4 hrs	A/501st Engr Bn	Enemy FSE 3-T80/8-BMP crosses PL Bush vic NAI 17 (NJ5700)	2-252 Scout TM-1					
1001 B2CSM01	MOPMS 2-Dispensers using RCU	Yes	Yes	N/A	70 x 50 m	NK 570840 NK 570839	NK 571840 NK 571839	N/A	50 m All sides	None	TM D 2-252 IN		Close Lane Blue vic PPI	4 hrs	A/501st Engr	Enemy: AGMB Crosses PL Dog Friendly:A/2-252 completes RPOL vic PP1	2-252 Scout TM-3					

Line 15: Action: Request Authority to Plan Scatterable Minefields.

Line 17: Authentication:

** Note: Information required for all ADAM-RAAMS minefields.

Purpose. This refers to the "targeting" aspect of planning scatterable mines as tactical or situational obstacles. The purpose clearly defines the tactical effect on the enemy's maneuver. Two examples of a clearly defined purpose: "Disrupt enemy counterattack at Targeted Area of Interest (TAI) 25" or "Separate the enemy's 1st and 2d echelons by 30 minutes at TAI 3."

Trigger. The trigger should be integrated into a decision point on the maneuver commander's decision support template. Typically, the trigger is an enemy action at a specific location, such as a named area of interest (NAI). The trigger should consider the time it takes for the enemy to move from the NAI to the TAI. The trigger allows the emplacing unit enough time to decide, emplace, and arm the scatterable minefield. An example of an effective trigger: "Enemy reserve 3 tanks/8 BMP counterattack at NAI 20." An example of a less specific trigger is "Advance guard main body (AGMB) @ Phase Line (PL) Gold." Some scatterable minefields may also require a friendly event in the criteria such as "Team A completes rearward passage of lines (RPOL) at passage point (PP) 2. Units should not use a time-based trigger to avoid emplacing a scatterable minefield too early or too late.

Observer. Specify the unit that is tasked to observe the trigger. Often, engineers can use the same scouts and observation points (OP) from the reconnaissance and surveillance plan or the combat observation lasing team (COLTs) locations from the fire-support plan. The unit observing or overwatching the scatterable minefield with direct or indirect fires may sometimes be designated as the observer for the trigger.

Conclusion

Brigade and task force engineers who incorporated the scatterable-minefield request and report matrix during BCTP Brigade Warfighter exercises demonstrated a definite improvement in employing and tracking scatterable minefields. Armywide, engineers must continue to improve the employment of 4- and 48-hour-duration scatterable minefields in support of the brigade and task force fight. At BCTP, engineer trainers remain committed to developing tactics, techniques, and procedures for planning, preparing, and executing scatterable minefields to successfully shape the battlefield.

Major Erst is an engineer trainer in BCTP Operations Group C.

National Training Center (NTC)

By Sergeant First Class Steven Bell and Sergeant First Class Robert Neal

On today's battlefields, engineer leaders are, more and more, pressed for time. Therefore, they must make work efficiently between missions to reconsolidate, resupply, and prepare soldiers and equipment for future operations. Two recent trends in these areas have been identified during training at the National Training Center. First, companies and platoons often lack effective SOPs for tactical assembly area (TAA) operations. Second, too little focus is placed on preparing the unit's equipment for continued operations.

Engineer Platoon TAA Procedures

Issue: Engineer platoons frequently do not have an SOP for TAA procedures.

Discussion: Engineer platoons often do not employ all chemical defense equipment (CDE). They also frequently do not establish tactical wire communications, protective obstacles, and listening posts/observation posts (LPs/OPs) for early warning.

Recommendation: Engineer platoons should develop specific SOPs for TAA procedures. The SOPs should be based on the company and battalion SOPs and doctrinal references such as FM 5-34, *Engineer Field Data*, pages 1-13 and 1-14. Emphasis should be placed on establishing priorities of work that enhance force protection. Security can be enhanced by performing quartering party operations, emplacing key weapons, emplacing CDE, establishing tactical wire (HOTLOOP) communications, maintaining radio listening silence on platoon FM nets, and performing "stand-to" procedures.

Volcano System Maintenance

Issue: Engineer Volcano crews frequently conduct inadequate preventive maintenance checks and services (PMCS).

Discussion: Vibration during cross-country travel in the M548 chassis often causes bolts, nuts, and electrical connections to loosen during movement. This can result in three types of failures: mechanical failure of the mounting hardware resulting in damage to the launcher or display control unit (DCU) as the launcher shifts; electrical connectivity failure between the DCU and the launcher panels; and connectivity failure between the launcher panels and the canisters.

Recommendation: Units should conduct daily PMCS according to Training Manual 9-1095-208-10-1, *Operator's Manual for Dispenser, Mine, M139 w/Mounting Kits*. Units should conduct combat checks according to Graphic Training Aid (GTA) 5-10-42, *Volcano Preventive Maintenance Checks and Services*, during extended hauls. Crews should conduct PMCS according to GTA 5-10-42 and conduct a full built-in test (BIT) on the DCU in the assault position before execution. At a minimum, crews should conduct daily inspections of all mounting hardware for tightness and conduct a daily BIT test, especially after cross-country movement.

SFC Bell is an engineer company trainer. SFC Neal is an engineer platoon trainer.

ENGINEER UPDATE

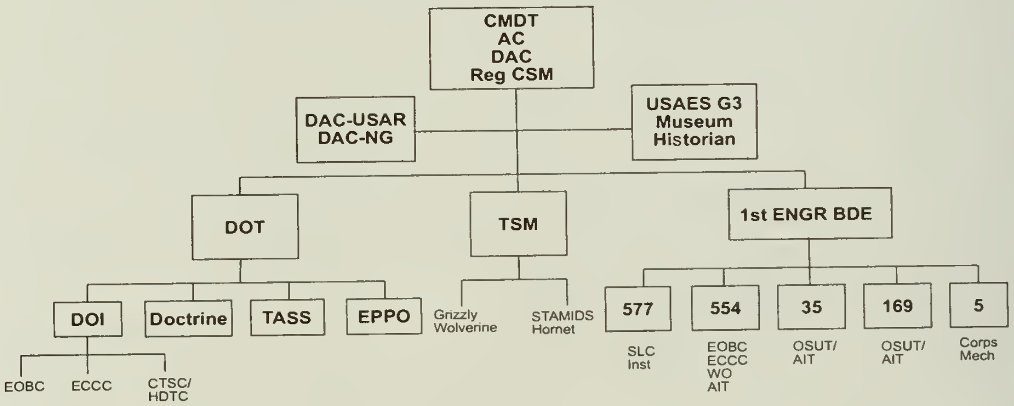
Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Deputy Assistant Commandant (DAC)

Engineer School Organization Under the MANSCEN. With the formation of the Maneuver Support Center (MANSCEN), the Engineer School has undergone a significant reorganization. The charts below show which organizations fall directly under the Engineer School and which fall under the MANSCEN, which provides general support to the Engineer School. The commandant of the Engineer School retains proponency for all doctrine, training, leader development, organizations, materiel, and soldier (DTLOMS) issues. It is through a matrixed organization—MANSCEN—that this support is provided in a synergistic (win-win) manner to the Engineer School.

POC is COL William Van Horn, -6192/8060.

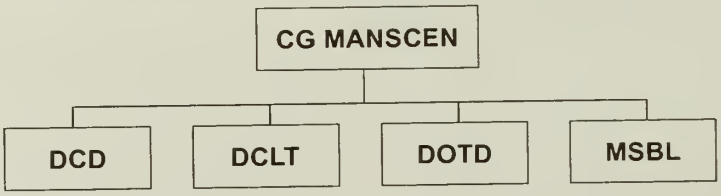
USAES Organization Under MANSCEN



DAC	Deputy Assistant Commandant
DOT	Director of Training
TSM	TRADOC Systems Manager for Combat Systems
DOI	Department of Instruction
TASS	The Army School System
EPPO	Engineer Personnel Proponency Office
STAMIDS	Standoff Minefield Detection System
SLC	Sapper Leader Course

EOBC	Engineer Officer Basic Course
ECCC	Engineer Captains Career Course
WO	Warrant Officer
AIT	Advanced Individual Training
OSUT	One-Station Unit Training
CTSC	Countermine Training Support Center
HDTC	Humanitarian Demining Training Center

MANSCEN Matrixed Support



DCD	Director of Combat Development
DCLT	Director of Common Leader Training
DOTD	Director of Training Development
MSBL	Maneuver Support Battle Lab

MANSCEN Web Site: *http://www.wood.army.mil/*
USAES Web Site: *http://www.wood.army.mil/eschool/*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals are at ATSC awaiting printing and distribution. They are currently available on the MANSCEN Publications Page at *http://www.wood.army.mil/PUBS/newpubs.htm.*

- FM 5-472, *Materials Testing.* This manual supersedes FM 5-530, dated 17 August 1987. It contains up-to-date technical information on how to obtain samples and perform engineering tests and calculations on soils, bituminous paving mixtures, and concrete. Many of the DD forms used to record and calculate samples have also been updated.

- FM 5-436, *Paving and Surfacing Operations.* This manual supersedes TM 5-331D, dated 21 April 1969; TM 5-337, dated 21 February 1966; and TM 5-337-1, dated 29 March 1971. It contains current information on construction materials and equipment and the mix design, production, placement, and repair of concrete and bituminous pavements.

- FM 5-434, *Earthmoving Operations.* This manual supersedes FM 5-434, dated 26 August 1994 and FM 5-164, dated 30 August 1974. It contains current methods and equipment used in planning, designing, and constructing earthwork in the theater of operations.

POC is Sandra Gibson, -4100.

Draft Changes to Doctrinal Publications. Another addition to our web site this month is seven draft changes to doctrinal publications supporting the 4th Infantry Division and the Division Capstone Exercise. Each draft change document addresses tactical operations conducted in a Force XXI (FXXI) digital environment. They serve as guides for FXXI engineers who use digital systems to plan, coordinate, and conduct digitized engineer operations. The draft change documents posted to *http://www.wood.army.mil/PUBS/fxxi.htm* and listed below are not stand-alone manuals (except for FM 5-105, *Topographic Operations*).

- C1, FM 5-71-100, *Division Engineer Combat Operations (Digital – CD)*
- C1, FM 5-100-15, *Corps Engineer Operations (Digital – CD)*
- C2, FM 5-71-3, *Brigade Engineer Combat Operations (Armored) (Digital – CD)*
- C2, FM 5-71-2, *Armored Task-Force Engineer Combat Operations (Digital – CD)*
- C1, FM 5-10, *Combat Engineer Platoon (Digital – CD)*
- C2, FM 5-170, *Engineer Reconnaissance (Digital – CD)*
- FM 5-105, *Topographic Operations*

POC is MAJ Ron Zimmerman, (573) 596-0131, ext 3-7332.

Tactics, Techniques, and Procedures (TTP) Web Site. To provide units with updated information and gain unit input to current doctrine, we have created the following web site for posting newly developed TTP that support the various working axes (DCX, JCF, LCD, I-BCT): *http://www.wood.army.mil/PUBS/ttps/engrttps.htm.* In the near future, we will be posting survivability TTP from the Waterways Experiment Station for various types of equipment. Please send comments and recommendations related to these TTP to *fmcommnt@wood.army.mil.*

POC is MAJ Ron Zimmerman, (573) 596-0131 ext 3-7332.

2000 Engineer Unit Directory. The directory, which is updated periodically, is available at *http://www.wood.army.mil/PUBS/dsd/dsd.htm.* Units may submit changes/corrections at any time via e-mail to Jennifer Morgan at *morganj@wood.army.mil.*

POC is Jennifer Morgan, -4104.

1st Engineer Brigade

Engineer Diver MOS 00B10 Course, Phase One. Previously taught at Fort Eustis, Virginia, this course has moved to Fort Leonard Wood, Missouri.The first nine-day course began on 20 February 2000. Phase Two, a 26-week course, is taught at the Naval Diving and Salvage Training Center, Panama City, Florida. For all reclassification requirements, see DA PAM 611-21, *Military Occupation Classification and Structure*; AR 611-75, *Management of Army Divers*; and AR 614-200, *Enlisted Assignments and Utilization Management*. The web site is *www.wood.army.mil/mosoob.htm.*

POC is SFC Patrick Andrews, DSN 581-2679, commercial (573) 596-0131 ext 6-2679.

Combat Engineer Vehicle (CEV). The CEV has been brought out of retirement for use in the Waco investigation.The CEV and crew will be sent to Fort Hood, Texas.

POC is CPT Kevin Hicks, DSN 581-8940, commercial (573) 596-0131 ext 6-8940/0224.

TRADOC Program Integration Office-Terrain Data (TPIO-TD)

Digital Terrain Data Requirements. TPIO-TD, which coordinates the Army's requirements for digital map data, is currently reviewing digital terrain data requirements submitted by numerous Army agencies and units. Requirements include high-resolution imagery, digital elevation models, and "smart" vector maps. TPIO-TD is consolidating these requirements and will forward them to the National Imagery and Mapping Agency this summer. These geospatial information requirements will be a topic of a breakout session at this year's ENFORCE Conference.

POC is CPT Tom Stroud, DSN –5180, commercial (573) 596-0131, ext. 3-5180.

TRADOC System Manager (TSM)

Handheld Standoff Minefield-Detection System (HSTAMIDS). This hand-held mine detector combines ground-penetrating radar and improved metal-detection capabilities to provide a robust probability of detection (Pd) for large and small metallic and nonmetallic antitank and antipersonnel mines. HSTAMIDS will significantly improve detection of the smaller, low-metal antipersonnel mines, such as the PMA-3, with a Pd that exceeds 95 percent. HSTAMIDS will reduce the frequency of false detections associated with detector operation in a metallic-cluttered environment, allowing the detector operator to "tune-out" metallic clutter that affects the AN/PSS-12. Six HSTAMIDS prototypes have been purchased by the Army to support contractor developmental testing scheduled for Yuma and Aberdeen Proving Grounds in April and May 2000. The Basis of Issue Plan for HSTAMIDS will be determined before Milestone III, Production and Fielding (FY03), based on training complexity and the level of soldier certification required to operate the system. Due to cost and training implications, HSTAMIDS fielding will supplement AN/PSS-12 systems already in the field and will not replace them on a one-for-one basis.

Basic Hornet and Improved Hornet. The Hornet is a smart munition designed to help the maneuver commander dominate his battlespace. The *Basic Hornet* engages tracked vehicles only and may be armed manually or by the M71 Modular Pack Mine System Remote Control Unit. Preplanned product improvement will result in an *Improved Hornet* munition with an advanced control station that operates through a standard Single-Channel, Ground and Airborne Radio System (SINCGARS). The *Improved Hornet* will include a remote on/off/on control to provide safe passage of friendly forces during counterattack, retrograde, or withdrawal; recovery and redeployability of munitions before arming; munitions with a built-in Global Positioning System; two-way communication between munitions and the control station; a more lethal sublet munition; and an improved probability of kill of both heavy wheeled and tracked vehicles. The primary recipient of the *Basic Hornet*, which is in production now, will be the 82d Airborne Division. The basic load of Hornets for a combat engineer battalion is 260 munitions. The current program schedule calls for the Army to receive the first *Basic Hornet* munitions in 4QFY00. The entire force will receive the *Improved Hornet,* with fielding to begin in 4QFY04. *Improved Hornet* control stations will be fielded to units as a Class VII item beginning in FY03. The Basis of Issue Plan for the control station is being developed. The expectation is that mechanized combat engineer units will receive one control station per squad, and light units will receive one per platoon. Maneuver units will receive one control station per company and one per battalion headquarters.

Information on both systems may be obtained at the TSM web site at http://www.wood.army.mil/TSM.

POC for both systems is MAJ Mark Thompson, (573) 596-0131, ext. 3-7347.

Lead the Way

By Command Sergeant Major Arthur Laughlin
U.S. Army Engineer School

Have a Little Faith

In March, I had the opportunity to brief LTG Ohle, the DCSPER. For me, this was a true education. It allowed me to see the workings of the Army at the highest levels. I came away from the briefing with the discovery that regardless of the level, things really don't change that much. To my surprise, I saw firsthand the concern LTG Ohle had about what young soldiers and sergeants in our Army were saying and thinking. He asked if our regiment's soldiers were aware of Chief of Staff GEN Shinseki's initiative to change the structure and man the field Army at 100 percent. He wanted to know how our soldiers reacted to that. He also asked how we were doing in the growing of our young sergeants and what percentage of our specialists were on the promotion list. I told him the results of my many conversations with our regiment's senior NCOs, but I knew he had put his finger on a great weakness in our regiment—a weakness we NCOs can fix by having a little faith.

Our regiment falls dreadfully short of the Sergeant Major of the Army's guidance to put 35 percent of eligible specialists on a promotion list. In nearly all of our MOSs, we fall short of where we need to be to build our sergeant ranks. We must do better. As NCOs, we must have the faith in our specialists to know they will be able to accept the responsibilities placed upon them. We also must give ourselves credit for being who we are and what we are capable of as NCOs and trainers. Our specialists will emulate their leaders, of that you can be sure.

Throughout my career, I have rarely seen an individual who is fully qualified before receiving that next stripe. The real training begins with pinning on the new rank. With the additional responsibility, these young leaders grew in ability and attitude to accept the challenges. They became junior leaders and better NCOs because mentors worked with them to *be*, *know,* and *do*. Mentors coached, guided, and forgave mistakes as each young leader grew in experience and knowledge. I know this was true in my case and for my generation of NCO leaders. Our senior leaders had a little faith in us and, through their senior leadership and risk taking, we became the NCOs we are today. So I ask you, why should it be any different today?

As NCOs, we have always prided ourselves on seeing the potential in our young soldiers. We saw and developed the qualities necessary to be a good leader. It wasn't always an easy call and, in some instances, we took a chance on soldiers and promoted them anyway.

Now, either we are afraid to promote and train, or we don't really see potential in most of the soldiers we recruit. I don't believe the problem is in the recruits, so the problem must be us. If that is indeed true, how do we change that? How do we regain the ability to see the potential of these future NCOs? How do we accept the challenge to have a little faith? This is our challenge. NCOs must be willing to invest in our subordinates, allowing them to join our ranks.

As I visit soldiers in the field, I hear first sergeants, platoon sergeants, and squad leaders tell me that soldiers must meet certain unit criteria to get boarded—criteria like appearing before soldier-of-the-month boards or successfully serving as team leaders or squad leaders. Great, but only if you are using these tools to identify talent really early. These are excellent tools to develop soldiers before they are eligible for the primary or secondary zone of consideration.

Don't use this unit criterion to hold back eligible specialists from promotion. Here is where you have to have a little faith or else you are holding your subordinates to a higher standard than I was or you were. Our regiment is in need of sergeants. It is up to us to train, board, promote, and train some more. So what are your standards? NCOs across the regiment have to be willing to invest in the potential of their subordinates. Take time and a little risk and have faith; your subordinates will follow you. The odds of success are in your favor.

Beginning 1 May 2000, your MANSCEN NCO Academy will begin an associate degree program. This is the first time I have seen such a program. If you are an NCO attending BNCOC or ANCOC, you will have an opportunity to earn an associate degree before returning to your unit. This is a great step forward for your professional development. More information is available at *http://www.wood.army.mil/mncoa/engin.htm.*

It is with great pleasure that I am able to announce the selection of CSM Bill McDaniels to be the new MANSCEN NCO Academy commandant. CSM McDaniels comes to us from the 864th Engineer Battalion in Fort Lewis, Washington. He has big shoes to fill after the outstanding leadership of CSM Jesus Gomez, but I am sure he will excel at this position. Please pass your congratulations and support to him. He will assume his duties in June 00.

Finally, the next time you encounter a subordinate, peer, or superior who doubts your ability to get a tough mission done, just look him or her in the eye and say, "Have a little faith. We can do this." Then, watch the twinkle in their eyes. Our specialists deserve a twinkle from us!

Essayons!

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AT URBANA-CHAMPAIGN

Prime Power

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CLEAR THE WAY

By Major General Robert B. Flowers
Commandant, U.S. Army Engineer School

The Regiment Needs You!

Uncle Sam wants YOU! I know that we all have seen at least one version of the ubiquitous posters of America's enduring symbol that implores us to serve our great Nation. The appeal of the gentleman in the red, white, and blue top hat and tails affects each individual's senses differently, but the message is clear to all—America is in need, and YOU can make a difference!

If we were to trace the history of the Army, the observation that the Army is in a perpetual state of transition would become glaringly evident. Whether the Army is transitioning from peace to war, or from this kind of structure to that, or going from unpreparedness to preparedness, the Regiment and its soldiers have always been needed. The Regiment has always made a difference. The Regiment has always responded to the call to serve.

Why do we serve? The reasons for service are well known and run the gamut from patriotism, to family tradition, to altruism, or maybe it's simply opportunity. Some view service in the military as an opportunity to achieve an ordered lifestyle, to attain higher education, or to have a second chance.

The Regiment and the Army are undergoing another period of transition. We're in the process of moving from Cold War force structure and mentality to the Chief of Staff of the Army's objective force through transformation. This transition (transformation) is occurring during an unparalleled period of economic growth, prosperity, and opportunity for civilian employment. Those of us in the Army continue to be pressed for service in all parts of the globe—whether it's conducting operational exercises or contingency operations or doing the work back in garrison for two and three of our contemporaries who are deployed.

Why do we continue to serve? We continue to serve for the same reasons we originally joined. For some we enjoy the lifestyle, the camaraderie, the pride in our work, and the contributions to our Nation and to the people around the world who have better lives because of our efforts. Additionally, how can we forget the countless souls we have protected from tyranny and oppression, or those we have provided an opportunity for a second chance?

Some are now saying to themselves, "So what! What has the Army done for me? My senior leaders have abandoned my family and me. The Army is no longer about warfighting, and the risks for my mistakes are too great. The 'PowerPoint® Rangers' have taken over the Army, and I've spent most of my career on repetitive deployments. Bottom line, the Army is not what I thought it was going to be, and the time has come for me to redirect my life."

I agree; it is time for all of us to redirect our lives. The time has come for all of us to join together—junior leaders, senior leaders, and new recruits alike. It is now time to rededicate ourselves to Uncle Sam's call to service, to renew our obligations to each other, to reconnect ourselves with our civilian communities, and to reaffirm our commitment to live up to the core Army values.

The Army's senior leaders are committed to their people. The Army is still about preparing for war and, if called upon, to fight and win. Yes, the Army is in transition. The Army is in a perpetual state of transition. As history has borne out, transition is good. As we continue to evolve, the Army, the Regiment, and the Nation will be that much stronger. I assure you that the Army's senior leaders are listening and are concerned about you and your family. As one of those leaders, I give you my personal guarantee that, standing together as One Team, we will rise above these uncertain times and resolve your well-being and quality-of-life issues.

I have been around the world many times. I have been in combat and participated in numerous operational deployments. In my three-year tenure as the Commandant of the Engineer School, I have been up close and personal with the best-educated; best-trained; and best-motivated soldiers, NCOs, and officers at any time in my career. The Regiment has set and will continue to set the standard for excellence because of YOU and your phenomenal commitment to service. The Regiment is about its people, and I am convinced that the Regiment has what it takes to see this period through and continue to embody the Sapper Ethos in all that we do.

I encourage you to keep the faith in the Army. The Army has faith in you. If not you, who? If not now, when? The Regiment needs YOU!

Essayons!

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Front Cover: *A prime-power soldier walks beside the current generation of large electrical power generators, the 750 kW MEP-208.*

***Back Cover*:** *The United States commemorates the 50th Anniversary of the Korean War (1950-1953).*

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U.S. Army Prime Power:
A Tradition of Innovation and Excellence

By Chief Warrant Officer 2 Andrew K. Potter

The 249th Engineer Battalion (Prime Power), one of the most unique organizations in the Army, carries on a long and proud tradition of providing excellence in engineering support to the nation. The very motto of Army engineers—Essayons—vividly captures the indomitable can-do spirit of these special soldiers.

The battalion's dual thoroughbred bloodlines trace through many crucial times in the history of our Army. This article is limited in scope and discusses only the unit's Corps of Engineers lineage but does so with full and grateful recognition of the gallant combat and construction ancestry of the unit's highly decorated namesake, the 249th Engineer Combat Battalion. After a long and storied history as a table of distribution and allowances (TDA) organization, today's prime-power battalion activated as a table of organization and equipment (TOE) engineer unit in November 1994 (see article, page 7).

Historical Perspective

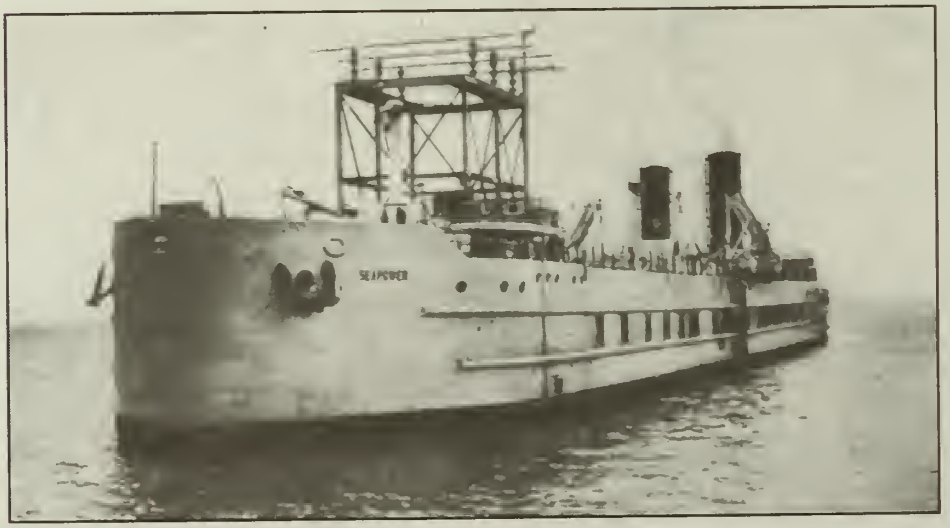
In the 1860s, the Army experimented with methods for protecting American harbors and channels. Torpedoes and mines emerged as the preferred systems, but the underwater firing devices did not always function. The Corps of Engineers perfected reliable, easy-to-maintain electrical firing systems using batteries and small magneto-based generators. Major Henry Abbot discussed the importance of power in his 1876 book *Notes On Electricity*: "The part which electricity now plays...is so important that an accurate knowledge of the leading principles of the science...are indispensable to the engineer officer." [1]

Coastal defense later included huge searchlights, networks of underwater mines and torpedoes, and on-site generators for power. Captain George Anderson, in his 1902 *Handbook for Electricians*, gave timeless maintenance tips: "Prevention is the rule for machinery troubles, not cures."[2] Regarding switch-gear: "No one should be allowed to touch the switchboard unless he is familiar with all circuits connected to it, the strength of main and feeder circuits, and the insulation of each part. Always close a switch deliberately and firmly, while watching the ammeter and voltmeter, and while standing ready to open."[3] This was good advice then and still is today.

World War II brought new challenges. Engineer soldiers used four power barges for on-site electricity, each equipped with a 30-megawatt (mW) generator driven by two marine-type, high-pressure boilers. The barges provided critically needed power to cities whose electrical grids had either been severely damaged or were overloaded by the demands of supporting the Allied ground advance. These one-of-a-kind designs, originally intended for use in the United States to meet anticipated wartime power shortages, saw their first use in the Belgian port city of Antwerp and later in Rotterdam and Manila.

Army Nuclear Power Program

The Corps of Engineers established the Army Nuclear Power Program in the 1950s. The Stationary Medium 1 (SM-1) plant, a 2-mW prototype at Fort Belvoir, Virginia, was the very first nuclear electrical-power plant to be paralleled to a commercial grid. It is commonly thought that the Shippingport, Pennsylvania, plant was first, but the Corps's SM-1 went on-line on 12 April 1957, more than a month before the Shippingport unit.



The power barge *Seapower*, one of four unique Corps vessels carrying a 30-mW power plant designed to augment war-damaged electrical grids.

Founders of the Army Nuclear Power Program carefully selected highly qualified officers and enlisted soldiers from the ranks to receive the grueling, year-long, reactor-operator training. The program produced several modular power plants, which were shipped in pieces to remote outposts as a test of the viability of nuclear power for far-flung military installations. One of these plants generated power from more than 30 feet below the polar ice cap at Camp Century, Greenland, a most unusual Corps outpost just 800 miles from the North Pole.

Army engineers carved Camp Century out of the ice in 1960 to house the Army's Polar Research and Development Center. More than a hundred soldiers and scientists lived and worked in this fascinating tunnel complex. On 12 November 1960, only 77 days after the pieces arrived on station, the compact 2-mW nuclear plant provided power, heat, and fresh water for the city under the ice. Camp Century supported the center until the summer of 1965. Similar plant installations were made in Antarctica, Alaska, Wyoming, and Idaho.[4]

The Corps's Engineer Reactor Group, as the nuclear program was named, advanced another first with the floating nuclear power station *Sturgis*. The 10-mW pressurized water reactor, mounted on a modified Liberty ship hull, became the first floating plant to regularly supply power to a shore station. It moored from 1968 to 1975 in the Panama Canal Zone, allowing the waters from Gatun Lake to be used for filling locks. The *Sturgis* was on-station during the height of the Vietnam War, allowing more than 2,500 more ships per year to pass through the canal than would have been previously possible.

The 2-mW nuclear reactor at Camp Century, Greenland, is home to the Corps's Polar Research and Development Center.

Prime-Power Battalion

In August 1969, Hurricane Camille struck the Mississippi Gulf Coast with destructive wind gusts in excess of 180 miles per hour and a 23-foot-high storm surge. In the final report on the effects of the storm, the Army Office of Civil Defense noted that "Portable power sources are highly useful in an emer-gency. The operational problems for distributing, installing, and running…emergency power generators have not been solved and merit further study."[5]

On 24 August 1992, the forward edge of Hurricane Andrew reached landfall 25 miles south of Miami. The winds ripped the anemometer off the roof of the National Hurricane Center, with the last recorded speed in excess of 167 miles per hour. In Homestead, 90 percent of the structures collapsed, leaving 50,000 residents with nowhere to live. More than 2 million people lost electricity. Four days later, Florida Power and Light estimated that more than 500,000 were still without power and would remain so for months. On order from President Bush, more than 16,000 soldiers from Fort Bragg, North Carolina; Fort Drum, New York; and other installations deployed to southern Florida. Among them were soldiers of today's 249th Engineer Battalion (Prime Power), the successors to the Engineer Reactor Group. In the first three weeks of that deployment, troops from the 249th installed more than 200 small- and medium-sized generators at critical facilities all across southern Florida, bringing desperately needed on-site power to people in crisis. The Corps of Engineers' tradition of excellent service to the nation continues today.

On-Site Power Needs

Modern military forces depend more and more on reliable, mobile electrical power. Health-service support, automation, communications, and weapons systems all rely heavily on electricity. In the Army, there is a critical gap in the electrical-power continuum between that supplied by small tactical generators (5-kilowatt [kW] to 100-kW) and the option for commercial power. Tactical generators are standard military sets distributed throughout the Army's fighting units, usually configured for multiple voltage and frequency output and ease of portability. The responsibility for setup, installation, and operation rests with the tactical unit.

When soldiers construct or modify large, forward-deployed military installations, tactical generators are often not sufficient to meet the concentrated demands for electrical power. Depending on the area and tactical situation, commercial power may or may not be an option. The 249th produces reliable, utility-grade power to bridge the gap. Headquartered at Fort Belvoir, Virginia, the battalion is comprised of highly trained soldiers who serve as installation specialists, plant operators, and maintenance personnel. Electricity generated by 249th soldiers is used as a supplement to tactical power, as a stand-alone source, or in parallel with a commercial source.

The battalion's primary mission is to generate and distribute prime, utility-grade power in support of warfighting, stability and support, and disaster-relief operations. The secondary mission is to provide advice and technical assistance in all aspects of power systems, with additional responsibilities in maintaining the Army's power-generation war reserves. This broad mission, which encompasses a tremendous range of

A student and instructor carefully check the schematic prints of a system inside a central-control van at the Prime Power School.

logistical and technical challenges, is accomplished through a distinct mix of equipment and people.

Equipment

The standard deployable power plant organic to each of the eight operational platoons around the world consists of four diesel-engine-driven generator sets, each capable of producing 750 kW at 4160 volts. They are in either a wheel-mounted configuration weighing about 25,000 pounds or a skid-mounted set weighing about 40,000 pounds. Both models travel in standard military aircraft, ships, and trucks with no modifications. To distribute the power to users, platoons have trailer-mounted substations complete with metering and switch gear. The four generators are controlled from a single, centralized control and distribution van. These systems are configured into a 2.25-mW (3-mW peak load) plant complete with primary and secondary distribution.

Other sets in the prime-power inventory include 500-kW, low-voltage, skid-mounted diesels; 1500-kW, skid-mounted diesels; and new 1500-kW International Standards Organization (ISO) container-mounted diesel sets, which are complete with a laptop computer as the remote-control and data-tracking panel. Most of these other sets are managed through the battalion's loan program, through which high-priority government sites borrow assets from the 249th to meet their critical needs. Both parties sign an agreement that the using agency will be responsible for operations and maintenance, while the 249th retains the responsibility for initial installation, training of the operators and maintenance technicians, regular inspections, and on-call assistance.

Soldiers

Soldiers are the key component for success in the 249th. Although equipment is certainly important in accomplishing the mission, without the highly trained, innovative problem solvers who make up this unit, the machinery would be idle. With only about 170 active-duty noncommissioned officers holding this specialized skill, the prime-power field is among the smallest in today's Army.

Imagine an independent group of 14 soldiers, each trained in an intense power-systems course, each constantly immersed in high-voltage safety as a way of life. These people are trained as innovative troubleshooting experts, not just parts changers. They perform both theoretical manipulation of problems and "down-in-the-dirt" practical work. On a job to install a power plant, for example, any member could draw out an accurate one-line diagram, solve and prove the capacity required to meet customer stipulations, and produce a detailed bill of materials and man-hours required. Those same people actively participate in the installation of the plant, providing either mechanical, electrical, or instrumentation systems expertise. They perform quality-control inspections along the way, and when the time comes to put the plant on-line, they analyze the load requirements of the moment and smoothly parallel the required number of units onto the grid. This same group of soldiers also serves as a preventive and predictive maintenance crew.

Does such a group exist? This is but a brief description of a single platoon of the 249th Engineer Battalion (Prime Power). The key component in building such a team is the initial training received by each person vying to become a member of this elite circle.

Prime Power School

Prime-power soldiers come from the active-duty enlisted ranks. Soldiers from any career field may apply, but they must be at least a corporal/specialist (E4). This generally means that they are on their second enlistment, with four to six years in the Army. Entrance requirements are stringent, with high scores required in the standardized tests for math and general technical subjects. Those who are accepted are grouped into classes of about 20, normally with two classes starting each year. They and their families are moved on permanent-change-of-station orders to Fort Belvoir, Virginia. There the soldiers are placed under the charge of the Prime Power School faculty, which consists of both civilian and military instructors.

The training is intense. The course of instruction is 52 weeks long, with eight training hours per day, five days a week. This school grew out of the Army's Engineer Reactor Group program. That tradition of superb technical qualification and rigid standards in power-plant-operations training has not changed. The course is broken into three phases: academics, plant operations, and technical specialty. The homework load averages three hours of work per night. It is one of the longest, most difficult courses in the Army.

During the academic phase, soldiers study mathematics, physics, mechanical and electrical theory, instrumentation and controls, and protective devices. In operator's training, the emphasis is on performance-based evaluation. The various types of sets in the inventory are introduced, and rigorous practical application and testing begins. Several mandatory manual paralleling exercises with both 750-kW and 1500-kW sets present a variety of changing load scenarios. Response time and accuracy of output parameters are tightly graded. Substandard performance in this phase is not taken lightly. A primary job of prime-power soldiers in the field is to operate the power plant. In the specialty phase, soldiers are split into one of three possible tracks: mechanical, electrical, or instrumentation and control. Each of these specialty tracks trains for more than four months in its particular discipline. After the grueling year-long course, soldiers graduate as fully certified, ready-to-work prime-power specialists.

Work in the Field

After finishing the Prime Power School, soldiers report to one of the eight operational platoons. A utilities warrant officer leads each platoon, which is divided into two operational sections, with a further breakdown of the technical specialties. Each platoon has two instrumentation, four mechanical, and six electrical specialists.

From this basic structure, many different teams of people are built depending on the mission. On large power-plant-installation jobs, one or two entire platoons may deploy initially to handle the first surge of work. Once complete, an operations and maintenance crew of perhaps only eight or nine soldiers may remain. Technical assistance or survey missions may require only one or two soldiers. Disaster relief might take the entire battalion, as was the case in 1992. In two short months during the summer and autumn of that year, two hurricanes and one typhoon (Andrew, Iniki, and Omar) sent the entire battalion to Florida, Louisiana, Hawaii, and Guam. The unit was stretched so thin that the battalion command graduated an in-session class of students two weeks early and deployed them directly to disaster-ravaged areas.

Technical Assistance

The broadest part of the prime-power battalion's mission statement is to "provide advice and technical assistance in all aspects of power systems." Each platoon has the skills and equipment to do just that. In addition to installing and operating any variation of the basic 3-mW plant, platoons carry out a tremendous range of testing, survey, and quality-assurance missions. A few examples are infrared surveys, high-voltage cable splicing and testing, overhead and underground distribution, power-factor-correction studies, substation maintenance, and protective-relay/circuit-breaker testing. The battalion also provides rapid-response support to victims of hurricanes, floods, and ice storms. Again, the key to success in all these missions is the soldier who makes all the systems work reliably, safely, and efficiently.

Innovative troubleshooting is the hallmark of technical assistance provided by prime-power soldiers. As an example, on a spring 1996 mission to provide power on an isolated grid to Soto Cano Air Base, Honduras, our platoon (which was stationed at Fort Leonard Wood, Missouri, at the time) walked into an interesting technical challenge. For the previous month, daily lunchtime outages plagued the 3.75-mW plant due to a fault somewhere in the 20 or so miles of 23-kV distribution. Our crew was technically responsible only for the installed power plant, but two of us were assigned as quality-assurance representatives for the electrical portion of the base main-tenance contract. The instructions from the colonel were clear: Fix this problem of daily outages, and do it now.

The faults were happening around the same time every day, with a tremendous surge visible on the plant metering just before the relays tripped out on instantaneous overcurrent. With no power-line monitors available and the maintenance contractor unable to provide much historical data, we pored over the distribution plans for likely suspects. Three branch circuits looked interesting, with big refrigeration and industrial laundry loads. With those three circuits isolated, however, the very same surge blasted our plant off-line the following day. We were certain that we had a high-resistance fault somewhere, only showing its ugly face when a decent-sized current was drawn across it. An infrared survey of the entire system that night showed no major problems. Crossing our fingers the next day, we increased the trip values on our plant overcurrent relays, hoping to send enough current down the line just long enough to blow something up. No luck—it just took a little longer to go out on overcurrent. We set the trip windows back to normal.

Because the fault was making it all the way back to the plant, we requested all distribution-system-fuse data from the contractor, which came through in the late afternoon of the second day. Normal high-voltage fuse protection should be in the range of 150 to 200 percent of full-load current values. The fuses for the five main feeders on base, however, were sized at more than 600 percent of full-load current, and the branch circuit fuses were sized between 500 and 1500 percent of full-load current. There was no coordination to the protection at all. We directed that the main feeder fuses be reduced to 200 percent of full-load current. The following day one of the main feeder fuses blew instead of our power plant taking that awful surge.

The rest of the third day, we had the contractor reduce all branch circuit fusing to 125 percent of full-load current. In some cases, due to lack of proper fuse sizes, the branch fusing went below 100 percent. Although this risked a few nuisance blows, it was certainly better than losing the entire base. On the fourth day, a single fuse at the main fuel-distribution point blew. The contractor replaced one transformer in the three-phase bank and our problem went away. We had no way to push enough current through the transformer on the bench to truly test it but, from the end result, it was pretty clear that a high-resistance fault had developed internally. This fault was only showing when one of the big pump-house motors turned on. Sure enough, the tankers that distributed diesel fuel around the base almost always went to the fuel point between 1100 and 1400 hours, and each day one or more of those motors kicked on to level out the belowground fuel tanks. We wrote up a procedure for protective coordination, made several strong recommendations for in-depth available fault current and full protective studies, and closed the book on a problem solved. We spent the rest of our three months in Honduras enjoying both the warm weather and operations shifts that were relatively free of outages.

Disaster Relief

The 249th is an integral part of the federal response plan to disasters. Under the direction of the Federal Emergency Management Agency, the Corps of Engineers has the lead for the public utilities and civil-works emergency-support function. The Corps often tasks the 249th to install temporary emergency power.

Disaster relief is among the most challenging, interesting, dangerous, and rewarding work performed by prime-power soldiers. Working safely is always at the front of your mind as you deal with fallen lines, overturned pad-mount transformers, the constant danger of back feeds from hurriedly connected small generators, wet ground, and unstable structures.

There is tremendous psychological stress imposed on everyone working in an area torn apart by natural disaster, and soldiers from the 249th are no exception. The pressures of working long hours with few breaks, constant short-fuse missions, the frustration of wanting to help everyone all at once, and the reality of seeing the lives of other humans torn apart all combine to weigh heavily on soldiers working to help.

As a specific operational example, prime-power soldiers installed over 200 small- and medium-sized generators during the six-week deployment to southern Florida following Hurricane Andrew. These generators, ranging in size from 10 to 750 kW, were put into operation at many critical facilities, such as police stations, hospitals, feeding centers, radio stations, schools, emergency shelters, supply distribution points, fire stations, medical and dental clinics, homes for the elderly, telephone-switching centers, pharmacies, and water-lift stations. In recent years, troops from the battalion have swiftly deployed on dozens of such humanitarian-relief missions following hurricanes, typhoons, floods, and severe ice storms.

The technical challenges of disaster relief are many. The job for prime-power soldiers consists primarily of assessing critical facilities for power needs and then installing the proper generator. Of course, things are not always that easy. Often, the critical facility identified for assessment consists of only half a building, along with half a distribution system, or a tent city with no distribution network at all.

Few street signs and landmarks remain after a major hurricane or typhoon. On our very first Hurricane Andrew assessment mission in Homestead, Florida, we drove right past the city. What we saw on the ground defies description – but it didn't look like a place where people had ever lived or worked. Bringing help to areas such as that is indeed satisfying work.

Some samples of my own thoughts during disaster relief are: *Can we rebuild that panel using #2 wire and tape? Is that half-overturned pad-mount hot? Do I hear a little 1.5-kW set running? Am I glad we have these police escorts; this traffic is unbelievable. Is there a back-feed through any of those wires laying on the ground? How can we possibly get a good ground for our generator anywhere in this muck that used to be a parking lot? How did half of a utility pole wind up in the attic of a community center? You know, lying on my back inside this switch-gear, in the middle of the night, with a wrench on this energized bus-bar, sweat pouring off me...is a really bad time to wonder when I last had my gloves certified. If we install a trailer-mounted set here, will it be stolen during the night? Why does this cell phone always cut out just when operations is telling our flying carpet where to go next? How did one crew use an entire case of electrical tape in half a day? Are we even at the right building?*

The Future

Major Henry Abbot, Corps of Engineers officer of the late 1800s, said in his *Notes on Electricity*, "The word electricity is used to designate a force that produces a class of natural phenomena of which the explanation is still shrouded in mystery."[6] True enough, but Corps of Engineers soldiers have made a proud tradition of removing some of that mystery, consistently generating reliable on-site electricity for Army commanders.

(continued on page 10)

The Next Generation of Power Generation

By Captain Jared Ware and Sergeant First Class Ed Dawe

The 249th Engineer Battalion (Prime Power) headquartered at Fort Belvoir, Virginia, is the Army's only power-generation and electrical-distribution unit. Its mission is to provide electrical power for warfighting, stability and support, and disaster-relief operations. Before 1994, the prime-power organization (table of distribution and allowances [TDA]) (provisional) had detachments at several CONUS and OCONUS installations with a primary mission to support Directorates of Public Works with electrical power and technical expertise (see article, page 2). Since 1994, when the unit activated as a table of organization and equipment (TOE) battalion, the 249th has been involved in several missions around the world.

As the twenty-first century begins, the 249th continues to be on the cutting edge of power generation in a variety of areas. The unit's A Company, which is at Fort Lewis, Washington, has worked on all three of the 249th's missions, with both civilian and military organizations. The 249th wants to ensure that the next generation of power-generation equipment and training is capable of satisfying the needs of the missions assigned to the battalion by the Department of the Army and the U.S. Army Corps of Engineers. Toward that end, the battalion has interacted with civilian academia, industry, and contractors to build better systems to meet the power-generation and electrical-distribution challenges of this century.

Power for Warfighting

For the past few years, personnel in the 249th, the Air Force, and several civilian companies have been preparing for a new generation of power-generation equipment. The effort began with a list of needs and will eventually culminate with the purchase of the Deployable Power-Generation and Distribution System (DPGDS). The system's components are described in the table on page 8.

As early as 1995, the 249th was asked for input on how to improve the power-generation equipment used by the military. The input centered on what could be done to improve the 249th's ability to support Department of Defense power missions. These missions are very diverse and covered everything from providing electrical power during the 1996 Olympic Games to powering a 4,000-person base camp at Guantanamo Bay, Cuba.

Since no other Army unit provides medium-voltage power, the 249th's equipment is as unique as its mission. However, the Air Force's Priority Improved-Management Effort, Base Engineer Emergency Force (PRIME BEEF) uses some of the same equipment for its bare-base power generation. Because a need for a new power-generation and electrical-distribution system was identified throughout the entire military, a decision was made that the new system would be an interservice acquisition. This reduces research and development costs and ensures a common power-generation system for both services.

In February 1998, personnel from the 249th and the Air Force reviewed several

Soldiers from the 249th Engineer Battalion (Prime Power) construct an underground electrical-distribution system in Bosnia.

Deployable Power-Generation and Distribution System

Component	Description
Prime Power Unit (PPU)	The unit is rated for 920 kilowatts (kW) at .8 power factor, 4160 V, 3-phase. It consists of two Caterpillar® prime movers (3456 engines), two alternators, one primary distribution center (PDC) with associated control panels, and the chassis.
Engine	Each engine/generator skid weighs about 8,000 pounds. Two personnel with a forklift can remove an engine/generator skid in less than 3 hours. The engine and its components and accessories are independent of each other and produce 460 kW at .8 power factor.
Alternator	It is prime-rated, 4-wire-wound, Class H, self-excited with permanent magnet. ▪ 60 hertz (Hz) operation: 4160 V, 575 kilovolt amperes (kVA), 460 kW, .8 power factor, 1,800 revolutions per minute (rpm) ▪ 50 Hz operation: 3800 V, 480 kVA, 383 kW, .8 power factor, 1500 rpm
Primary Distribution Center	The DPGDS power-distribution center has two feeder circuit breakers and one load-tie breaker. The load-tie breakers connect PPUs and provide a common bus for the electrical grid. The common bus uses two 200-ampere load-break elbows per phase to accommodate the desired current.
Chassis	A main design goal for the Army version of the chassis was that the unit be Department of Transportation highway certifiable (it can be towed at 55 miles per hour by a standard tractor). However, the Army version is restricted from C-130 and C-141 aircraft due to its height and weight.

proposals. Only one system met all of the criteria of the system-requirements document. The two most important requirements were to reduce the number of aircraft needed to deploy the equipment and to increase fuel economy. Of the 30 personnel reviewing the proposals, the only active-duty Army person was from A Company, 249th Engineer Battalion. His task was to read the proposals, check the technical content, and ensure that the proposals would meet the Army and Air Force specifications. On 13 March 1998, the contract was awarded to Radian Inc., which is an integrator and produces no equipment.

Introducing a new piece of equipment into the military system requires a thorough understanding of its future logistical needs. This is one of the major reasons the 249th was included in the DPGDS research and development. The Army once stocked all its own replacement parts, but that system is being updated with the *Just in Time* logistical model. Radian Inc. has proposed a new and radically different way of supplying parts, which uses the worldwide distribution system from Caterpillar®. The user identifies the replacement parts, then orders, receives, and purchases them directly from the local Caterpillar® dealer—using the international merchant purchase authority card (IMPAC) VISA. Under this plan, the Department of Defense would no longer maintain an inventory, and obtaining parts would be much quicker. Caterpillar® can provide most parts within 24 hours and can provide 98 percent of all replacement parts anywhere in the world within 72 hours. For locations too dangerous for civilians, or where the local government is hostile, the dealer would deliver the parts to the military installation closest to the operation site. Then, the installation would be responsible for getting the parts to the user through its own supply channels.

After the DPDGS prototype was assembled, the following tests were performed: ambient; hot-temperature; cold-temperature; solar; sand, wind, and rain; humidity; fuel-consumption; road; and altitude. The final phase of testing began in June 2000 at Holloman Air Force Base, New Mexico, and it should be completed by September 2000. The Air Force Operational Testing and Evaluation Command, which is conducting the testing, invited all DPGDS stakeholders. Called the Qualification Operational Testing and Evaluation, this final phase has a two-fold purpose: to test the equipment in a "real-world" environment and to ensure that soldiers and airmen can learn to operate, maintain, and troubleshoot the equipment in a reasonable amount of time.

Radian Inc. will develop a program of instruction for training soldiers and airmen. Although the DPGDS equipment is very similar to existing prime-power equipment, it will still require a major change in the mission-essential collective tasks and potentially in prime-power doctrine. Overall, the new DPGDS will effectively improve and enhance prime-power capabilities in the twenty-first century, similar to the way the MEP-012A 750-kilowatt generator changed the Army's power-generation capabilities in the mid-1980s.

Power for Stability and Support

Operation Joint Endeavor was the setting for the 249th Engineer Battalion's electrical-power contribution to the Task Force Eagle base in Tuzla, Bosnia-Herzegovina. A Company assumed the power-generation mission on 1 January 1999. Initially, the goal was to continuously operate a 5-megawatt power plant and

The key Army component of the DPGDS, the 920-kilowatt PU810B generator, shown here at a manufacturer's facility in Illinois. The PU810B was on display at ENFORCE 2000 at Fort Leonard Wood, Missouri, in May.

supervise contractors on the construction of an electrical-distribution system (see photo above).

While preparing to transition to commercial power, the major operational concern was to develop a procedure to restore the base's power in the event of a power outage. After war-gaming several methods, A Company developed an SOP based on its own power-plant operations. A power plant can parallel to the local utility company, offering both peak shaving capabilities and load testing for generators. It can parallel to the utilities before a scheduled outage, thereby isolating the base camp from commercial power (this option keeps continuous power to the base). It can also be used to reenergize the base after an unscheduled outage. In any case, the base must schedule an outage with the local utility company before returning to commercial power from prime power.

After developing the SOP, A Company's mission was to train local nationals and Americans contracted by Brown & Root, the contractor selected to provide logistics support in the Balkans, to operate and maintain a power plant and transition the base camp from prime power to commercial power. The employees included diesel mechanics, low-voltage-generator operators, and exterior high-voltage electricians, but none of them had any training on large, medium-voltage (750-kilowatt) generators. A Company developed a unique training program that took into account the various levels of experience. The program ensured a safe, efficient, knowledge-based program that focused on the "three Cs": concept, cross training, and contract. The training program was conducted in both English and Serbo-Croatian, with translators on-site.

During the concept stage, everyone trained on the basic operation of a power plant and became familiar with the equipment and its functions. The cross-training stage provided an overview of each person's duties and responsibilities. Mechanics learned basic electrical skills and wire diagrams, and electricians learned how to work on engines and order generator parts. During the contract stage, A Company personnel ensured that all employees understood and followed the power-plant contract. Unlike soldiers, contracted employees can only perform their particular job according to the specifications in the contract. This ensures that the proper skills are applied to the power plant and that all employees adhere to safety checks.

The entire mission proved successful for the 249th and its stakeholders. The local nationals and the Brown & Root personnel quickly learned power-plant operations, passed a "scheduled-outage" training exercise, and took over full plant operations in April 1999. The Task Force Eagle base camp successfully transitioned to commercial electrical power, and the plant has remained in a "back-up" status since June 1999. The lessons learned from Operation Joint Endeavor allowed the 249th to train with local nationals and develop tactics, techniques, procedures, and doctrine for future stability and support operations around the world.

Power for Disaster Relief

Emergency power is one of the most important elements to local communities in the event of a disaster. Without power, critical facilities cannot operate effectively and contribute to the relief effort. In the Federal Response Plan, the Department of Defense is responsible for the Emergency Support Function 3 (ESF3) (Public Works) cell, which encompasses emergency electrical power. The Department of Defense delegates the emergency-power mission to the Corps of Engineers, and the Corps further delegates it to the 249th Engineer Battalion (Prime Power). The ESF3 cell, which has a prime-power representative, sends the 249th a list of electrical assessments for facilities deemed mission-critical by local government authorities. The 249th conducts facility assessments, used to "size up" the electrical load of the facility, and provides the information to the ESF3 cell. The cell then coordinates for installing generators at the assessed sites.

In most instances, the 249th is the disaster effort's "reconnaissance element" that determines the routes for transporting the generators to the desired facilities. Hurricanes, floods, tornadoes, and earthquakes tend to make road routes and critical facilities difficult to identify, and often the existing damage slows the relief effort. In most cases, local governments have difficulties with identifying their electrical needs and critical facilities *after* a disaster strikes.

The Los Alamos National Laboratory in New Mexico is developing an Internet-based computer-simulation model to help decision makers during natural disasters. The Corps of Engineers' South Pacific Division's emergency-operations planners invited the A Company commander to provide an "emergency-power perspective" to the development of the simulation model.

The current model simulates the effects an earthquake would have on the Los Angeles Basin's power grid. The Web-based model will contain damage estimates from potential earthquakes; mission, operational modes, and general information about the stakeholders; and an interactive Web site where stakeholders can coordinate planning issues. By using a predictive model, decision makers can identify the potential damage an earthquake will present to the power grid. With this information, planners can identify which critical facilities will be without power and for what duration.

Currently, city planners have identified more than 50 critical facilities in the greater Los Angeles area, which include command-and-control centers, hospitals, and water-treatment plants. The 249th is working with the Corps of Engineers to develop an earthquake-disaster scenario to test the simulation model and train its soldiers on disaster-relief operations in an urban environment. By training for disaster relief using the latest simulation models, the 249th can ensure that its stakeholders will have electrical power at critical facilities in the event of future earthquakes or other natural disasters.

Remaining Relevant

A Company will continue to seek training opportunities with the joint, civilian, and academic communities that tie into the company's three distinct missions. As the Army transforms into Force XXI, the 249th Engineer Battalion (Prime Power) will remain relevant by addressing the electrical needs of the Army and the nation. A Company trains with the Federal Emergency Management Agency and the civilian side of the U.S. Army Corps of Engineers for emergency-power disaster-relief missions. The company also provides support to joint-task-force headquarters such as Joint Task Force Pacific Command for Exercise Cobra Gold in Thailand and to Joint Task Force Bravo for border-patrol missions. The company deploys annually to Korea to provide its technical expertise to the Eighth United States Army for the joint and combined exercises on the peninsula.

A Company is one of only two multicomponent companies in the Army; the other is B Company, its sister unit at Fort Bragg, North Carolina. The 249th is a model for the Army's future force structure, where both strong technical and tactical expertise at the individual and collective levels are necessary for mission success. The 249th Engineer Battalion (Prime Power) stands ready to accept the twenty-first century's challenges for the country and abroad.

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Sergeant First Class Dawe is a platoon sergeant in 1st Platoon, A Company, Schofield Barracks, Hawaii. He served as the Project NCO for power-plant operation at the Task Force Eagle base camp and was the DPGDS liaison for the 249th Engineer Battalion.

(continued from page 6)

The Army's electrical needs will continue to grow. The trend is toward more mobile weapons systems and vehicles. The electrical sources to supply those systems will become more mobile as well (see article, page 7.) Whether produced with diesel engines, gas turbines, fuel-cell devices, nuclear power, or some other new technology, increasing amounts of electrical power will be consumed in the Army of tomorrow. The 249th Engineer Battalion (Prime Power) will be there, trained and ready to provide support anytime, anyplace. Responsive, respected, and reliable prime-power soldiers will continue to produce utility-grade power and provide that all-important, in-person technical assistance to support the Army mission.

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Endnotes:

[1] Major Henry Abbot, *Notes on Electricity (In Its Applications to Submarine Mining)*, Torpedo School Battalion Press, (Sergeant Carmichael, Printer), December 1876, Chapter 1.

[2] Captain George Anderson, *Handbook for Electricians in the Operation and Care of Electrical Machinery and Apparatus, D. Van Nostrand Company, New York, New York*, 1902, *p. 5.*

[3] Anderson, p. 64.

[4] Army Office of Civil Defense, "The Effects of Hurricane Camille on Industry, Public Utilities, and Public Works Operations," URS Research, San Mateo, California, 1970, p. 73.

[5] Charles Daugherty, *City Under the Ice: The Story of Camp Century*, MacMillan, New York, New York, 1963.

[6] Abbot, Chapter 1.

Constructing a MOUT Training Village

By Major Michael C. Wehr

How does an active engineer construction battalion execute great training, improve its installation, and contribute to the training objectives of a maneuver division…all in a span of five months? One way is to be prepared to seize every opportunity. The 92d Engineer Combat Battalion (Heavy) (ECB[H]) at Fort Stewart, Georgia, (known as the Black Diamond Battalion) is just that. During one five-month window of opportunity, the unit became part of the solution for a 3d Infantry Division (3ID) stabilization-force (SFOR) training challenge and executed its construction mission with tenacity. The result was Ern Karo Village, a training village for military operations in urban terrain (MOUT). The process could only have taken place with a solid foundation of readiness. The battalion was guided by the motto "Maintenance Is the Foundation for Everything We Build."

How well did this foundation of readiness work? The requirement occurred after the 92d ECB (H) returned in late November 1999 from a deployment to Egypt for Exercise Bright Star 2000. By mid-December, the entire battalion had signed up for another major construction mission with a very short suspense. This was possible only because our constant focus on readiness, even through a deployment, ensured the flexibility to launch into any mission that became available.

Seize the Opportunity

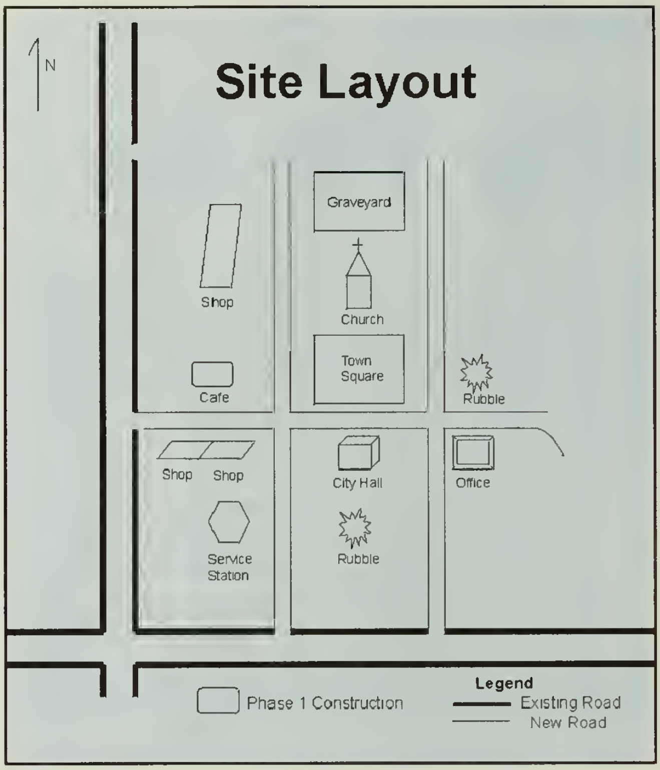
Early in December of 1999, the 3ID was deciding how to establish training lanes for the SFOR deploying to Bosnia (SFOR 8-9). One idea was to build a MOUT village. The problem was how to keep the cost low and still get a world-class training facility that could be used for many years. The 92d ECB (H) became part of the solution. Since we had a proven track record with a high degree of success in both Bright Star and a company deployment to Haiti, we knew we could be ready.

During the remaining weeks of December, while the battalion was recovering, we put together a proposal that would contribute to the training requirements of SFOR 8-9. The mission was to produce a usable MOUT facility within four months, no later than 1 May 2000. After analyzing the mission, the battalion established the following mission statement:

> *The 92d ECB (-) builds an 8- to 10-structure MOUT village starting 03JAN00 and finishing NLT 01MAY00 in the vicinity of MR223425 that meets the requirements of SFOR 8 and can be integrated into future MOUT training on FSGA (Fort Stewart, Georgia).*

The intent of the battalion commander was to provide Fort Stewart with the first-class engineering support required for constructing a MOUT training village. This mission would be accomplished by executing it at a rapid but sustainable operational tempo. Companies would have the flexibility to plan and execute their projects within an agreed-upon schedule, while sustaining maintenance and personnel readiness. Upon completion of the mission, the MOUT village would meet the training requirements of SFOR 8-9. The mission would be successful if the 92d ECB (H)—

A soldier from the 92d ECB(H) receives on-site guidance from a DPW engineer.



- Satisfied the units and agencies it supported.
- Improved construction skills of its soldiers without compromising safety.
- Sustained its equipment at combat-ready (10/20) standards.
- Maintained individual soldier deployablity and family readiness.

Designing the Buildings

To jump-start the planning process, we developed our own proposal and then sought endorsement from the 3ID. We used a village layout from previous SFOR training at Fort Carson, Colorado, to develop a concept sketch. For the buildings, we used a basic, single-room-schoolhouse design that we had just produced in Haiti. The structure was of concrete-masonry-unit (CMU) block, which provided a known reference point for company planning and material estimates. We knew that each of our four vertical platoons could build at least two schoolhouse-type structures in the required timeframe. Our concept sketch included nine structures that varied in construction effort (see figure above). The plan included two rubble buildings, two shop buildings, an office building, a service station, a cafe, a city hall, and a church. Because of the proven village design from Fort Carson, the 3ID immediately supported the general concept of the layout and the CMU-type structures.

Briefing the Commander

A mission of this magnitude and time constraint had an impact on previously planned activities and how normal garrison activities were conducted. This was best demonstrated by the fact that we gave our quarterly training briefing (minus the MOUT construction) to the commanding general on the morning of 7 December, followed by our proposal to execute the MOUT construction that very afternoon. We had to use a completely new calendar. We included a detailed breakdown of changes that would result and our ability to execute other missions. Our goal was to immediately establish an agreement on the support and current tasking relief we would need to accomplish the MOUT mission.

Defining the End State

The most important part of the agreement was the definition of the end state and what constituted success. The division approved the battalion commander's intent. The overall agreement reached was that two-thirds of the battalion would be considered in a deployed status, especially important due to the one-hour travel time from garrison to the construction location.

Setting Up for Success

Besides this deployed status, the 3ID and various garrison agencies were instrumental in setting us up for success on our "deployed mission." What was originally listed as assumptions in our briefings rapidly became fact. Representatives from the garrison command and range control and the G3 quickly agreed on a site for construction. The G3 agreed to manage the training activity in the area and arrange to share facilities to ensure uninterrupted construction. The Directorate of Public Works (DPW) took the lead on critical design requirements, materials procurement, special-equipment rental, and environmental and building permits. Using the basic building design of the schoolhouse, we produced a rough estimate for materials, the procurement of which DPW immediately put into motion. The majority of the materials would not change in type but would adjust slightly in quantity. All of this support allowed us to start work on 3 January, less than a month after approval of the initial briefing to the 3ID commander.

One of the most dramatic selling points to our proposed mission was the cost savings realized if we constructed the MOUT village rather than hire a civilian contractor. The project had to produce a usable facility under $500k to meet statutory requirements. The majority of the estimated cost was for materials ($386k). Rental equipment and operational tempo constituted $26k and $88k of the estimate, respectively. The estimated savings for the installation in labor and design costs was estimated at more than $700k. The true value of the 92d ECB (H) construction effort was our ability to react quickly.

Execute the Mission

The training opportunity sounded too good to be true. The 92d ECB (H) had written its own mission statement, received funding, and had tremendous support from higher headquarters and the installation, namely the DPW. However, as with any mission—especially those that are accelerated in the planning phase—there are challenges in

A view of city hall in the background at the village

execution. But the teamwork required and achieved throughout the ranks of the battalion and with various agencies on the installation made the MOUT village a reality. The 92d ECB (H) maximized the training opportunity and remained flexible to changes.

Split-Base Operations

The battalion staff was faced with the challenge of a split-base operation. Rather than deploy the battalion tactical operations center (TOC), the battalion staff continued with garrison operations, in addition to supporting the project site. The administrative, logistical, and operational support each had a different center of gravity.

Administrative Support. This support, which included logistical maintenance support, was based in the garrison. The S1 shop and motor pool provided support to the companies primarily on days when there was no construction. The usual schedule was four construction days and one administrative day each week. Initially, this depended heavily on the weather and the delivery schedules of materials. For the first few weeks of horizontal earthwork and foundation construction, the platoons worked as quickly as possible. This minimized weather impacts by getting the project "out of the ground," or having completed slabs for each building. Coordination with the DPW for ground insecticide preparation, inspections, and delivery of premixed concrete was the major benchmark for identifying which days would be used for garrison administrative support. However, once block work began, administrative-support days were more predictable.

Logistical Support. The center of gravity for logistical-materials supply was on-site, primarily because a materials yard had been established. The battalion also established other life support on-site, to include a mobile kitchen trailer, sleep tents, an ambulance with a medic, and an equipment park. Although this infrastructure had to be guarded at night, the stockpile of supplies prevented construction delays due to nonavailability of materials or equipment. It also streamlined the delivery of materials with the easier and quicker method of bulk "throughput" of resources to the location. An officer assigned to run the materials yard developed a tracking system to validate requests and initial estimates of materials. Even more importantly, the tracker provided a record of the materials required to build each structure. The initial estimates took on an accurate resolution for future construction-materials estimates. The most efficient method of gaining this information was on-site materials support.

Operational Support. Operationally, the S3 section had the same challenge of split-base support. However, the center of gravity was information, not the location. The primary ingredients for success at the construction site included a full-time inspector and a small version of the battalion TOC. This provided information needed for a systematic approach to internal and external reporting. There was no substitute for having a full-time battalion-level inspector (a sergeant first class) on-site. He provided the main link between the DPW and the leaders of the platoons that were building the structures. This coordination with the DPW inspector and procurement representatives was invaluable because of the incomplete design details, an inherent part of fast-track construction. As the platoons needed clarification, the battalion inspector worked through the specifications with the DPW. This worked so well that all design changes were accomplished on-site.

At this point, it is important to note that the support provided by the DPW on-site was key to project completion. The more efficient construction techniques that were relayed to the soldiers and the ability to design while constructing kept the project on schedule. The small battalion TOC included a computer that each platoon used for updating its construction schedule as it encountered changes and made progress.

Methodology

The methodology of managing this project at the battalion level hinged on accurate and updated construction schedules. The intent was to maximize the training value of this project since we had established our own mission statement. While most construction projects result in well-trained craftsmen, leaders often only react and execute instead of exercising true planning and managing. To maximize the opportunity, the S3 construction officer used a software program called Microsoft® Project. The goal was to track a project with the same database that would be used to report on its status, and this software made the goal a reality.

From the start, platoons developed their own construction logic networks (critical path methods [CPMs]). The initial battalion construction meeting involved a review of the best (most detailed) platoon CPM, followed by the distribution of all the platoons' CPMs to each platoon leader. The intent was to learn from each other and increase the overall project-management quality. Within two weeks, the construction officer consolidated the project files into a master battalion file. Immediately, the battalion S3 could identify and work through any resource or timing conflict. Weekly reports involved a construction meeting, platoon-leader status updates, company commander briefs to the S3, and a status update to the battalion commander.

The resolution on project status offered by Microsoft® Project enabled the battalion to immediately assess the impact of any changes in the construction schedule. Armed with this knowledge, both internal and external schedule challenges could be met with a real-time answer. This ensured that all decisions were based on quantitative impacts. Internally, the software program allowed the companies and platoons to determine the amount of overtime required to make up for delays. Also, if an unforeseen requirement (such as mandatory training) pulled soldiers off the construction site, the actual impact could be assessed. This information was used to help decide when to execute the newly identified training.

Even during the construction phase, we never lost sight of maintenance being our foundation. Platoon leaders also discovered the capability to track equipment services using Microsoft® Project. They could identify the soldiers and equipment (as resources) that would be unavailable for construction and immediately know the effect on project duration. Externally, the biggest challenges were in the form of taskings from higher headquarters and potential work stoppages due to concurrent training exercises in the same area. The battalion was able to quantify the impact of a tasking or work stoppage in terms of the resulting additional construction days. This knowledge always convinced higher headquarters that forcing the tasking or work stoppage was not worth the delay in the project completion date.

Information was the center of gravity for the operation, and the computer, digital camera, and cell phone made information work for the battalion. The computer was the primary tracking tool for construction status and material accountability and provided the leverage needed to work through the challenge of split-base operations. The digital camera provided an invaluable means for conveying the ground truth via e-mail and various presentations. While not just a way to document progress, photos were used to aid in making decisions and to generate or maintain interest in our remote project site. Besides the on-site visits that these photos prompted, there was no better way to convey the results of employing the 92d ECB (H) for construction projects. Without the cell phone, coordination would have been too slow to keep up with the demanding schedule of this project.

With all this overhead staff coordination, the companies and platoons executing the mission must be singled out as the

Ern Karo Village, shown on 11 April 2000, was constructed in three months by the 92d ECB at Fort Stewart, Georgia.

primary reason for mission accomplishment. With a freedom to execute and manage their own schedules, they finished the project in time for the 1 May ribbon-cutting ceremony.

The ribbon-cutting ceremony after completion of the village

Challenges

Incomplete plans can be a challenge to fast-track construction, and this project was no exception. Companies initiated planning with only concept sketches of buildings. Each building evolved throughout the construction period as time allowed. The intent was to move from the basic square structures of the Haiti schoolhouse to more detailed structures that would resemble a village, maximize the available funds, and still meet the deadline.

The most extensive design modifications involved the church and city hall. For example, the floor supports, interior layout, stairs, building heights, vault trusses, openings, porches, and cupolas were all modified. Some building elevations, wall offsets, and shop measurements were changed on-site. Other changes that had to be scheduled included staggering buildings to produce hidden corners, adding awnings and patios on cafes and shops, defining building areas with sidewalks, and installing other visual improvements such as lights and signs. The platoons had time to incorporate these changes because of an aggressive schedule throughout the project. An example of this included an initial one- to two-week deployment on-site.

Another significant challenge that the companies overcame was split-base operations. While the focus was forward at the construction site, garrison requirements did not stop. Company leadership had to contend with garrison operations and project supervision. One lesson learned involved the significant challenge of a company executive officer in handling the mission of the company construction officer and primary company maintenance officer. Meeting times shifted to take into account the travel requirements from the site to the garrison. Despite the challenges of initially incomplete drawings, design changes, and competing garrison/project responsibilities, the companies and platoons made it all happen and produced a village well beyond the 3ID's expectations.

Mission Accomplishment

A construction battalion can control its own destiny if it can demonstrate to higher headquarters that it can meet new challenges and still sustain its readiness. Because of the overwhelming success of the MOUT training-village project, the post leadership's trust in the 92d ECB (H) is tremendous. Consequently, the battalion has been offered several major construction projects to improve Fort Stewart's infrastructure, which will provide even more opportunities to enhance our construction skills. The process can work for other engineer construction battalions as well.

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***Acknowledgements**: The opportunity to write this article is the direct result of working with outstanding Black Diamond soldiers and their leaders and the battalion staff. During the development and execution of the project, the following individuals provided direct operational support to the battalion S3: LTC Bob Carpenter (battalion commander) showed us what a foundation of maintenance could build; 1LT Jamie Chapman (battalion civil engineer for planning) understood the commander's intent and compiled the concept and estimate to prove that the mission was possible; 1LT Zach Miller (battalion civil engineer for execution) mastered Microsoft® Project and convinced senior leaders to use it; 1LT Troy Funk (battalion civil engineer for logistics) coordinated exterior support and material tracking to ensure no project delays due to material shortages; 1LT Eric Goldman (battalion S2) forecasted the weather and described its impact and coordinated for photographic support; SFC (P) Danny Muth provided quality assurance during split-base operations; Mr. Tim Whitehurst (DPW, Chief of Buildings and Grounds) helped ensure more efficient techniques throughout the project; Mr. Don Pons (DPW, Material Expediter) coordinated material deliveries directly from vendors to the construction site.*

Looking for the Perfect Leader

By Major Ronald E. Zimmerman Jr.

"The implications are certainly far more than just platforms. They are organizational. And they're also people skills...we are working on producing leaders for change, not just leaders who are doctrinally capable and competent leaders for warfighting but leaders also for all kinds of missions...capability to continue to deal with an evolving global situation in which the array of threats that you face goes across the entire spectrum..."[1]

Honorable Louis Caldera
Secretary of the Army
October 1999

The perfect leader is a twenty-first-century soldier who is adaptive in nature. This soldier knows and can read enemy actions, can make sense out of those actions, can adapt the commander's plan while maintaining its integrity, and then has the strength to deal with the changes. "Reduced to its essence, adaptive leaders are those who have a feel for the fight. The ability to read the situation allows our twenty-first-century leaders to analyze the cause-and-effect relationships of various courses of action from the beginning to the end of an operation—the second- and third-order effects."[2]

An adaptive leader is capable of translating the variables of combat (geography, weather, capabilities, strategy and tactics, mission, civil and military operations, and time) into situational understanding and cause-and-effect relationships. At the Center for Army Leadership at Fort Leavenworth, Kansas, an adaptive leader is defined as "A leader who can influence people—by providing purpose, direction, and motivation—while operating in a complex, dynamic environment of uncertainty and ambiguity to accomplish the mission and improve the organization."[3] Adaptive leaders have multidimensional thought and analysis versus sequential or "cookbook-style" processing.

Is the evolving twenty-first-century leader a result of our changing operational environment or changes in the information age brought on by increased technology in digital command and control? Is there a leadership framework for the twenty-first-century leader? How will we train this leader? Just as important, is the twenty-first-century leader attainable and retainable?

Army of Excellence

Success in today's Army of Excellence has a direct relationship to three concepts. First, better soldiers were recruited as a result of the volunteer force. Second, structured training programs were developed with defined tasks, conditions, and standards—all coupled with training realism and assessment. Lastly, junior leaders were supported by the policies and programs of their leaders, both military and civilian.[4] Since the end of the Cold War, the Army has used this foundation to build better training and leaders, while responding to various crises throughout Southwest Asia, Africa, Southern Europe, and Central America. Surprisingly, each of these crises has a commonality of reliance upon young Army leaders in a decentralized execution of mission intent. As an example, a squad leader whose squad is manning a checkpoint is repeatedly making decisions with the potential of second- and third-order national effects.

Operational Environment

The operational environment of the future continues to represent conditions and operations as seen in the Sinai, Iraq, Rwanda, Haiti, Somalia, Macedonia, Bosnia, and Kosovo. These operations include a wide range of stability operations and support operations, to include small-scale contingencies and possibly major theater-of-war engagements. According to the Fort Leavenworth Battle Command Battle Lab:

> *Worldwide challenges focus a U.S. national-security strategy of engagement that contributes to global stability and prosperity in the twenty-first century. The rapid emerging of regional instabilities and transactional issues (such as terrorism, rogue states seeking power and resources, proliferation of weapons of mass destruction, natural disasters, and belligerent actions between state and nonstate actors) signals a less predictable and more diverse world. As a result of the geostrategic environment and the national military strategy, the Army is transforming itself into a force based on capabilities for shaping and responding to crisis, while simultaneously preparing for future threats.*[5]

The most dangerous threat our twenty-first-century leaders face will come from an armed force of an industrialized or developing nation that seeks to combat U.S. forces through activities ranging from terrorism, illegal drug trading, illicit arms trafficking, international organized crime, and deliberate environmental damage. This threat will most likely be a dismounted infantry that fights from small towns or enclaves and uses tangible efforts against the rule of law and public opinion with the intent to harass and keep the American force in a defensive posture. The changing threat, complex environments, and more requirements with fewer resources set operational environmental conditions centered on crisis, change, and instability.

In the future operational environment, young Army leaders will operate on decentralized mission execution only after thoroughly understanding their commander's intent and scheme of maneuver. Their leadership style will evolve around transformational leadership behavior versus transactional, developing and communicating a vision that their soldiers can rally around, and individualized soldier concern and self-sacrifice.[6] Twenty-first-century leaders communicate their vision through words and personal examples to provide purpose, direction, and motivation.

Information Technology

The integration of information technology launched Army leaders into the twenty-first century. Operations Desert Storm, Just Cause, and Joint Endeavor opened a visionary window on the capabilities of the information age. The future battlefield with integrated technology has—

- A larger battlespace at a higher tempo.
- Increased lethality through precision munitions.
- Massing of effects versus massing of forces.
- Increased ability to visualize a battlefield consisting of both friendly and threat forces.

Army Battle Command System technology systems integrate the functional elements required to plan, prepare, and execute a full range of operations in basically any environment—ultimately providing a secure, vigorous, and survivable communications network for voice, data, and video. Information operations give leaders relevant friendly information and enemy intelligence, as well as weather and terrain data. Collectively, relevant information and intelligence provide the situational awareness and battlefield visualization necessary for twenty-first-century leaders.

Increased command-and-control capability gives Army leaders the advantage of enhanced near-real-time situational awareness and ultimately increased understanding for employment of assets at the right time and place. Twenty-first-century leaders rely on situational awareness of their environment to help fully understand their surroundings and recognize how political, cultural, economic, and ethical factors impact their operations. Future leaders will require a deeper understanding of their operational environment as it relates to peace and conflict and the demands those relationships place on their leadership style.

Leadership Framework

For each level of leadership, enhancements in technology have brought great opportunities. Our Army must continue to exploit those opportunities in leader development, while maintaining leaders with character and competence who act to achieve excellence in themselves, their soldiers, and their organizations. The basics of yesterday hold true today. Our Army must continue to develop leaders who provide purpose, direction, and motivation, while operating to accomplish the mission and improve the organization. Our future will involve fast-paced operations in complex and changing environments, shaped by leaders who are—

- Comfortable with ambiguity.
- Team builders with roles of trainer and mentor.
- Accelerated, passionate learners.
- Flexible and innovative.
- Skilled at developing concepts.
- Tactical experts with technical proficiency.[7]

Our Army has always been and is still about winning our nation's wars. Leadership in the pursuit of that mission is each Army leader's primary responsibility, challenge, and opportunity. Army leadership is solidified by the character, competence, and excellence of its leaders and their values, attributes, skills, and actions.[8] Soldiers of tomorrow will enter the Army with inherent digital and analog skills as a foundation to their scholastic preparations. They will be extremely knowledgeable in network use and capable of making complex decisions. *In some ways, these young soldiers and leaders, having grown up in an environment of technology and expanded skills, will tower over our existing leaders.* But although they will be technologically enhanced, tomorrow's soldiers and future leaders will enter the Army without the knowledge to achieve excellence in leadership.

Field Manual (FM) 22-100, *Army Leadership,* surrounds itself with what leaders must BE, the skills they must KNOW, and the characteristics and knowledge they must apply to DO what they must.[9] The framework of BE, KNOW, and DO (from FM 22-100) describes characteristics of our twenty-first-century leaders.

What Leaders Must BE

Soldiers enter the Army with values and attributes formed by environmental influences, such as family, friends, schools, religion, and television. However perfect these values are, they begin the definition of the total person and describe in essence what that person stands for. From entrance into or association with the Army, soldiers and leaders begin a pyramid of building on their character. The intent is to enhance, refine, and develop their existing values into the seven Army values described in FM 22-100:

Loyalty
Duty
Respect
Selfless Service
Honor
Integrity
Personal Courage

These values are the foundation of leadership. For our Army, they are "points of light" that drive our actions in peacetime through combat, providing the force (soldiers, leaders, and civilians) with building blocks for what is right and wrong. These seven values—coupled with mental, physical, and emotional attributes—collectively influence what a leader must BE.

What Leaders Must KNOW

The twenty-first-century battlefield is fast-paced and riddled with technological enhancements that increase information flow to the leader. These enhancements are all centered on greater knowledge and understanding of the situation. Our twenty-first-century leaders are tactical and technical experts who rely on concrete values to assimilate the complex information flow, conceptualize plans of actions, and utilize interpersonal skills for leadership—all with the intent of mission accomplishment. KNOWing their occupation becomes an essential variable of the leadership model, as our twenty-first-century leaders are passionate learners with a drive for increasing their skills. KNOWing does not come easy; it requires hard and realistic training that is founded on practical experience and individual and collective training. The words "task," "conditions," and "standards" continue to embody Army training.

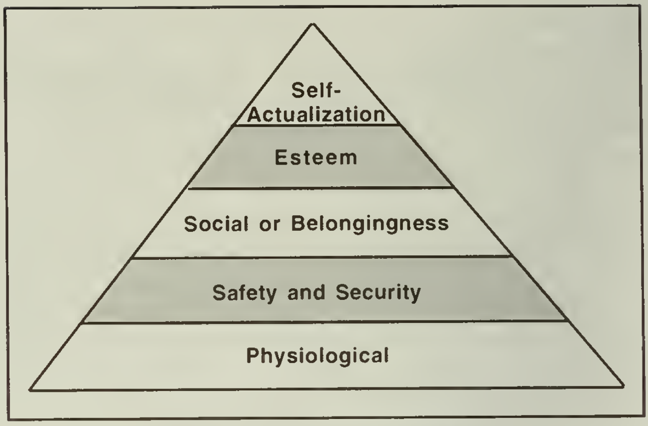
Training of the future must address improvements in technology, however resource-intensive the event. Developing and tailoring realistic training are essential for honing soldiers' and leaders' skills in adaptability, conceptualization, flexibility, and innovation. Training must continue to progress from individual, team, and squad or section up to the unit. Proficiency demands challenging training from the time a soldier enters the Army through unit training to build on the success of previous training and sustainment of perishable skills.

What Leaders Must DO

Leadership is the art of bringing together values and attributes; knowledge and understanding of the working environment and applicable skills; and providing purpose, direction, and motivation. *Leadership is about open dialogue, not Web-site posting.* Twenty-first-century leaders will find their leadership styles (the DO portion of leadership) fluctuating between direct, participating, delegating, transformational, and transactional leadership styles. Varying conditions will determine the style use and, to a certain degree, the mixture of each style for mission accomplishment. Leader characteristics in the twenty-first century may very well be dominated by soldiers' esteem needs.

Influencing Forces

In Maslow's hierarchy of needs (see figure), esteem is defined as peoples' self-respect tied to their pay, responsibility, recognition, and respect.[10] Senior leaders may find that their junior leaders, both commissioned and noncommissioned, struggle to identify their responsibilities. The young leaders' increased capabilities in technology and ability to learn quicker will drive a need for more and more challenging responsibilities. Self-esteem that is tied to responsibility and contributing effectiveness is directly related to the retainability of soldiers and leaders. At the end of the day, leaders and soldiers of tomorrow will (more than ever) need to feel a sense of accomplishment and job satisfaction.



Maslow's hierarchy of needs

I believe there are basically three types of forces that influence recruitment and retention in our Army: environmental, social, and individual.

Environmental

Collectively, environmental forces such as economic conditions, educational opportunities, political influences, and technological advancements help define American attitudes toward a military lifestyle. A strong economy, fueled by opportunities and advancements in technology, means higher wages. Because of a better lifestyle, young American parents now have the ability to provide their children a higher education without using scholarships offered by the military. As fewer and fewer Americans enter the military and are associated with the military, a lack of understanding develops concerning the importance of variables within the military model. Programs begin to be cut, less capital is resourced for military programs, and soldiers' self-esteem becomes harder and harder to maintain. Military lifestyle becomes a negative "word-of-mouth" expression that is soon a transitional expression for the want of a livelihood outside the military.

Social

Social needs are the sense of belonging and identification with a group. These needs are nurtured by religious activities, professional organizations, sports, or social clubs. The longing to be a part of something and to share the same interests, values, and attributes is a strong need. As we enter the century of technology where computers and digital enhancements dominate the working environment, soldiers can easily become disillusioned about their responsibilities as team members. If decisions become centralized because of digital enhancements, and the chain of command becomes more of a continuity line for zero-defect versus a command-and-control feature, retention will be lost. If done correctly, twenty-first-century leaders can capitalize on individual social needs as an enhancement to their leadership style. Motivation has second- and third-order effects when working as a team is both challenging and rewarding, and those intrinsic rewards are spread across the life-style environment from the workplace to the sports field.

Individual

These forces include individual and family perceptions of military lifestyle. Soldiers in the armed forces have a unique personality, a particular set of learned experiences, and a perception of how best to achieve their goals. Educational opportunities and funding of educational goals provide great assistance in recruitment. However, without challenging opportunities for growth in esteem and self-actualization, retention suffers. As fewer and fewer Americans have associations with the armed forces and our borders remain safe, families begin to think less about a strong defense. Reliance on a strong economy fuels further budget cuts on low-priority governmental programs. The lack of familiarization with the armed forces and a complete sense of security lead to military program cuts. I propose that our advertising efforts focus on the intangibles of military lifestyle—the benefits of being a team member, camaraderie, esprit de corps—and that we get back to the grassroots feeling of why soldiers remain members of the Army team. Let's advertise the goodness of our organization, not just what the Army gives us as a preparation for life outside the military after four years.

Conclusion

Technology enhancements provide the foundation for twenty-first-century operations. Leaders will improve their ability to make timely decisions; manage abundant amounts of information; and communicate purpose, direction, and motivation—all to accomplish the operational mission. Digital skills become normal operating procedures in the exploitation of information technology for situational awareness, understanding, and decision making. Tough, creative, realistic individual and collective training based on existing training theories will drive our future leaders to higher plateaus in education and job prowess. This realistic training will help our leaders and soldiers develop the knowledge and skills required for winning our nation's wars. Our future leaders will maintain the Army values of Loyalty, Duty, Respect, Selfless Service, Honor, Integrity, and Personal Courage to BE, KNOW, and DO as their leadership framework. Our Army must build on recruiting and retaining only the best and ensure that each and every soldier and leader is challenged as part of the unit team.

We, as any Army and nation, must not fall into the Chicken Little "sky-is-falling" mentality. As we enter this transformational period, we must remember that each challenge is really an opportunity to improve. The U.S. Army Engineer School's command sergeant major says it best: "Take time and a little risk and have faith; your subordinates will follow you. The odds of success are in your favor."[11]Leadership basics hold true. Leaders of the future must never forget that leadership is about open dialogue, not about Web-site posting. As we search for the perfect leader, we must incorporate leader development into all levels of training and fully embrace flexibility and encourage creative innovation.

Major Zimmerman will attend the 00/01 class at the Command and General Staff College, Fort Leavenworth, Kansas. He was previously a doctrine writer in the Directorate of Training, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

Endnotes:

[1] Colonel Jon H. Moilanen, Chief of Staff, Task Force TLS, U.S. Army Command and General Staff College, "TLS Strategy Brief," TRADOC DCST Training O&O Conference, Fort Benning, Georgia, 8-10 November 1999.

[2] Based on my informal research, interviews, and working knowledge of Force XXI, Joint Contingency Force, Strike Force, Interim Brigade Combat Team, and Task Force TLS from September 1998 through date of this article.

[3] Ibid.

[4] Lieutenant General (Retired) Frederic J. Brown, Ph.D., *The U.S. Army in Transition II*, Brassey's (US), Inc., Washington, 1993, p. 126.

[5] "TLS: A Strategy for the Human Dimension in Twenty-First Century Readiness," Battle Command Battle Lab Leavenworth, Task Force TLS, http://cacfs.army.mil/CIDivision/Tls/strat28.htm

[6] Major Kevin S. Donoue and Major Leonard Wong. "Understanding and Applying Transformation Leadership." *Military Review,* Vol. LXXIV, No. 8, August 1994, pp. 24-31.

[7] Based on my informal research, interviews, and working knowledge of Force XXI, Joint Contingency Force, Strike Force, Interim Brigade Combat Team, and Task Force TLS from September 1998 through date of this article.

[8] Ibid., pp.1-3.

[9] U.S. Army Field Manual 22-100, *Army Leadership,* Washington, D.C.: Government Printing Office, 31 August 1999.

[10] Barry L. Reece and Rhonda Brandt, *Effective Human Relations in Organizations*, 6th ed., Houghton Mifflin, Boston, Massachusetts, 1996, pp. 151-175.

[11] Command Sergeant Major Arthur Laughlin. "Lead the Way: Have a Little Faith." *Engineer Professional Bulletin*, Vol. 30, April 2000, p. 49.

ENFORCE
Breakout-Session Summaries

By Captain Sam Hudson and the ENFORCE Team

The ENFORCE 2000 conference in May included an afternoon devoted to breakout sessions that allowed attendees to hear about, and discuss, some of the most important issues, concerns, and future programs that will likely have a tremendous impact on the Engineer Regiment. Six sessions from this year's conference are summarized below. A seventh session, which was primarily a U.S. Army Reserve general-officer session, was devoted to echelons-above-division engineer-battalion redesign.

Combat-Training Centers

By Major Daniel Dolwick

Representatives from the National Training Center (NTC), the Battle Command Training Program (BCTP), and the Combat Maneuver Training Center (CMTC) provided presentations on issues, lessons learned, and observations from their respective combat-training centers. The audience consisted of senior engineer leaders from the Active and Reserve Components and the National Guard.

The NTC representative stated that engineers need to be a force in the presence of our maneuver brethren. He encouraged attendees to use the following methodologies:

- Battle commanders should—
  - See themselves, the enemy, and the terrain, and apply the "so what" drill to each.
  - Visualize, decide, and lead.
- Understand and apply doctrine through—
  - Combined-arms integration.
  - Self-study.
  - Officer professional development.
  - Certification programs.

The BCTP representative clarified that the BCTP uses "perceptions" as opposed to "trends," since their observations are a snapshot in time of a single unit versus several units over a long duration. BCTP perceptions for mobility and survivability are that—

- Commanders and staffs do not make effective use of scatterable-mine systems.
- Neither the G2 nor the engineer S2 continuously templates enemy countermobility efforts.
- Commanders do not maximize countermobility capabilities or effects.
- Engineers participate in deep-targeting planning, but results are mixed.

In preparing for a CMTC rotation, some "keys to success" are that—

- Units must leave their home station with trained crews.
- Units must leave Grafenwhor Training Area with trained platoons.
- Commanders must personally focus on mission-critical assets (such as the Volcano and MICLIC).
- Command-and-control tools (such as timelines and synchronization matrices) must be developed and used continuously.
- Class IV/V supply movement and management depends on detailed planning and coordination before arrival.

Regimental Synergy

By Reginald Snodgrass

This session concerned synergy among the three components of the Army—Active, Reserve, and National Guard. Three main idea topics for discussion were—

- How do units learn about training exercise availability and requirements?
- How do we get the word out to units about the Center for Engineer Lessons Learned (CELL)—what the CELL can do for units, and how units can help support the CELL?
- How do we tackle the partnership problem between components to ensure a better working relationship?

The following issues and recommendations resulted from the discussion:

Issue: There is no central location where e-mail addresses can be found for all engineer units.

Recommendation: That a database, which is available to everyone, be established that contains addresses for all engineer units. If the unit address is a personal e-mail address, develop a method for ensuring that the address is changed if the point of contact changes, or establish a permanent e-mail address for units.

Issue: There is no way for engineer units to determine what training exercises are being planned and which ones still need unit participation.

Recommendations: That a database be established identifying training missions, requirements, and points of contact. That a worldwide, training-exercise conference be held to identify training missions and their requirements.

Issue: How do we solve problems with computer systems (such as the pay system) when multicomponent exercises are being planned or conducted?

Recommendation: That a method (an SOP) be developed for working through the system to increase the likelihood that multicomponent training exercises will be conducted.

Issue: Training exercises and requirements are not advertised in a timely manner, nor are they built on table of organization and equipment (TOE)-type structures (such as squad, platoon, and company).

Recommendation: That training exercises be advertised at least three years in advance. Encourage all agencies that are developing an exercise to establish requirements based on some type of TOE structure.

Issue: Many units have never heard of the CELL.

Recommendations: That the CELL be advertised in Engineer School publications (such as the *Engineer Professional Bulletin*). That units read Director of Training (DOT) and Directorate of Combat Developments (DCD) notes. (To get on the distribution list for DOT notes, contact Jim Evans by e-mail at *evansj@wood.army.mil*. Read DCD notes at *http://wood.army.mil/DCD/dcd.htm*).

Issue: How does/should the CELL collect lessons-learned information from units conducting exercises or missions?

Recommendations: That the CELL request after-action reviews from units that conduct exercises. That the CELL post a form on the Web site outlining the information that units should submitted.

Personnel Retention

By Major John Dvoracek

This session was designed to facilitate discussion between senior engineer commanders about current officer-retention issues, particularly captain retention. Representatives from PERSCOM, AR-PERSCOM, and the National Guard Bureau briefed attendees on current personnel-retention actions in their organizations. Discussion centered on the most common reasons cited as causes for dissatisfaction with or separation from the Army. These included—

- "Zero-defects" mentality.
- Micromanagement.
- High OPTEMPO.
- Poor leadership.
- Poor "quality of life."
- Lack of family time.
- Loss of benefits from service.
- Too much "do-more-with-less" mentality.
- Lack of faith in senior Army leadership.

Feedback from the attendees indicated that most installations and organizations are actively working to solve these problems, when possible, at their level. Additionally, leaders are extremely emotional about many of the reasons officers give for leaving the service. The audience acknowledged that each leader must work harder to maintain a positive attitude and mentor the officers working for them in order to improve retention. Finally, the loss of quality officers is not confined to one component (Active, Reserve, or National Guard) and requires a number of different solutions to address each component's specific needs.

The Grizzly and Wolverine Programs

By Major Mark Streeter

The TRADOC Systems Manager - Engineer Combat Systems conducted this session and presented the current status of the Grizzly and Wolverine programs. Key points of the initial briefing were—

- Program Budget Decision 745 (PBD 745), dated 27 December 1999, cut the funding for Fiscal Years (FY) 2000, 2001, and beyond for the Grizzly and Wolverine programs.
- PBD 745 was purely a budget decision that was driven by the Army's need to find funding for the transformation.
- The Grizzly and Wolverine programs are positioning for success.
- The short-, medium-, and long-range actions for both programs and the possible outcomes after congressional markups are released.
- The days of 366 Grizzlies and 465 Wolverines are gone. We can expect about 160 Grizzlies and about 168 Wolverines for the active Army when the programs are restored.
- The bottom line is that the Grizzly and Wolverine are coming back.

The following questions, answers, and attendee feedback resulted:

Question: *When Congress plusses up the programs, will it still continue with experiments and testing?*

Answer: Yes.

Feedback: There is also a greater ripple effect. An Army-imposed 6- to 7-month delay in program startup equates to a much longer actual delay, because there is a learning curve associated with rehiring former workers or acquiring new workers. Time has passed, and former program personnel have moved on to other jobs. New employees will have to learn everything that was known about the program up until the time it was "terminated." From a contractor's viewpoint, it is difficult to hold on to people. Everyone is looking for other opportunities. This is a risky timeframe.

Question: *For the initial brigade combat team (IBCT), is there an opportunity to develop or use off-the-shelf technology (for engineers)?*

Answer: Right now the design is open for the IBCT. We will still depend on the Grizzly and Wolverine for the heavy forces. The requirement to breach complex obstacles is a simple physics problem. We need a vehicle with the weight and power of the Grizzly to plow through obstacles at the required depths.

Feedback: The government loves high-technology solutions but will not accept risk. Concerning the IBCT, engineers are low on the list and will have to wait a long time to get a new system.

Question: *Will the 168 Wolverines be fielded only to III Corps? What about the rest of the force?*

Answer: We are looking at our options. We could field a lower density of Wolverines to the force to spread the wealth. We could do nothing. Or we could upgrade the armored vehicle-launched bridges (AVLBs).

Question: *How about mounting the Mongoose on the Wolverine?*

Answer: Do we want to put the Mongoose on an $8 million piece of equipment? We don't want to do it right now, but we do have a preplanned product improvement for such an action to be looked at in the future.

Question: *What about turning in all AVLBs?*

Answer: That is an option we can consider. All options are being looked at.

Feedback: It's a political decision. As long as the AVLB is around, it provides the Army a path of least resistance. With the AVLB, we still have some gap-crossing capability. The Army can apply a "Band-Aid® fix" to the AVLBs more cheaply than it can replace them. There is not enough money available to do all the things the Army wants to do.

Question: *What about the 57 sappers the force lost when the Grizzly was terminated? Are there plans to put them back?*

Answer: Yes, there are plans to put them back in the modified table of organization and equipment (MTOE).

Feedback: Termination of the Grizzly and Wolverine becomes a retention and morale issue. It's difficult to recruit and retain quality engineer soldiers if all they have to work with is old technology and equipment. The Grizzly and Wolverine would certainly help retention among engineer units. It is a real cause for concern to start up a great program only to have it killed years later. There is a real concern from the field that without the Grizzly, soldiers are still in harm's way and still out in the open to perform breaching while the tankers sit in the comfort of their protected systems.

Engineers must make known how badly they need these programs and keep pushing for them.

Topographic Concepts

By Lieutenant Colonel Earl Hooper

The topography breakout session provided an opportunity to review the year's significant activities of the Terrain Visualization Center (TVC) and the TRADOC Program Integration Office - Terrain Data (TPIO-TD). The session opened with the results of the worldwide staffing of the National Imagery and Mapping Agency (NIMA) prototypes used to demonstrate the Foundation Data Concept. General timelines were provided with foundation data completion projected for FY05.

The status of topographic concepts for the heavy division, interim brigade, and interim division and a general review of the Corps headquarters and headquarters company O&O (currently on hold) were discussed. Although it is not a working concept, a view was provided of the notional Corps Topographic Battalion and notional options for a theater support structure. The shortage of 81T and 215D personnel to fill the expanding role and mission of these soldiers was of prime concern. The current growth in topographic structure will continue to exacerbate the shortage of soldiers over the next five to seven years. The role of terrain-data manager is the primary training concern with the emerging concepts of support. There is clear agreement that data management will require special training that currently is not available to the 81T or 215D soldier. These training issues will be addressed in the concept effort noted below.

A presentation was also made of the Army Imagery and Geospatial Information - Integrated Concept Team (ICT). The cosponsored ICT between the Engineer and Intelligence Schools provides the forum to jointly develop future concepts, training strategies, and system architectures required to take

(continued on page 27)

The Art of the Engineer Staff Ride

By Captain Robert F. Hynes

When the subject of conducting a staff ride is mentioned, the first question that often comes to mind is why. When training resources are so short, why spend time and money on a staff ride when there are platoons and companies to be trained? We hope that staff rides will make us better commanders, but there are a number of reasons for conducting them. William G. Robertson, author of *The Staff Ride*, lists 13 purposes of staff rides, with the end objective being to further the professional development of U.S. Army leaders. In analyzing a staff ride that the 307th Engineer Battalion at Fort Bragg, North Carolina, conducted in Vicksburg, Mississippi's Civil War Military Park and comparing Robertson's objectives, I came to this conclusion: *Experience the historical battle from the perspective of a commander or a soldier on the ground.* Regardless of our unit objectives, most of us can agree that experiencing the battle is an outstanding opportunity to further develop the professionalism of leaders at all levels.

Conducting the Staff Ride

The 307th Engineers chose the Civil War Military Park for its staff ride because of the work engineers performed there during the war. The campaign for Vicksburg lasted through the spring and into the summer months of 1863. Because of redoubts overlooking the river, the Confederates were able to blockade the Mississippi River from the Federals through well-placed artillery. Because Confederate forces had occupied the town since the beginning of the war, they had ample time to prepare the defense. During the course of the planning and execution of the staff ride, I identified several planning principles that were key to success. With these simple tips, you can turn your battlefield tour into an exciting training opportunity.

Choose the Right Expert. To be a professional experience, a staff ride needs a facilitator, an expert on the history of the campaign who can answer and ask the questions that stimulate the learning process. It may or may not be someone from the unit. Just as in any presentation, the speaker must be chosen to fit the audience. Ask yourself, What is the experience level of the staff riders?

Most of the tour guides at the Civil War Military Park knew the locations in detail but were not historians. We wanted someone who had studied the history of the battle and could relate it to lessons learned in modern warfare. We selected a professor from the Department of Military History at West Point, because he could explain the principles of war and the tactical perspectives of a commander.

Do Your Homework. Let's face it; it is difficult to plan for a staff ride while performing the constant tasks of training, maintenance, and daily operations. In fact, it is difficult even when the staff ride is a high priority. The first requirement is ownership. As the S3, it was my operation, and it would succeed or fail based on how I prepared for it. Some units task one officer to be in charge, but I recommend against it. Command emphasis is always the key. The S3 or executive officer needs to be the driving force to divert resources to the project without letting routine operations suffer.

As a matter of policy, each member of a staff ride needs to research ahead of time. But rather than leave that entirely up to individuals, come up with a training plan. Set the milestones ahead of time. Assign certain areas of responsibility to each unit to make it the resident expert on a particular area of the battle or possibly a historical commander. Give sufficient time to research, and then tie everything together. After assigning areas of the siege of Vicksburg, I presented an officer distribution plan on the overall campaign. The presentation was general enough that everyone understood the campaign, but it also focused on and tied the bits of research into the overall scheme. The diversity of the research areas helped to stimulate questions during the presentation.

Delegate. Assign areas of research to the staff-ride members. Make each company responsible for researching and presenting a site along the tour. This is a great way of dividing the work while forcing the members to learn. I conducted a thorough reconnaissance a couple of months ahead to ensure that I was assigning good research. Then the companies went to work.

The key is quality not quantity. Although the urge may be to try to squeeze as much training as possible into an entire day, remember that it is supposed to be fun. Do not risk losing everyone's attention by over tasking. One site per company was an easily achievable goal. Each of the five companies in our battalion presented about 45 minutes' worth of material, and all had enough preparation time to make a quality presentation.

Be Creative. This is very important. The purpose of the staff ride is to experience the battlefield from the perspective of a commander or soldier on the ground. One of the most effective ways to do this is to use the terrain. What can we learn historically about this terrain? One site in particular, Thayer's Approach, required the Union forces to attack up a nearly vertical slope against Confederate parapets. Imagine what that must have been like. To practice, we encouraged members of the group to try running up the hill. It was exhausting, but we learned a great lesson. There are always new ways to add spice to the presentation. Find some authentic uniforms or take the time to examine some actual weapons of the battle.

Our study of the Louisiana Redan presented the case of Union miners tunneling under the Confederate parapet and blowing it up with 800 pounds of TNT. When the hole opened in the parapet, an entire infantry regiment stormed the gap, attempting to break through the lines and capture the fort. The battle lasted nearly two days with the Union forces eventually withdrawing.

To experience the battle, we began with a rock drill on a terrain map prepared ahead of time. Each member took the role of a particular commander or historical figure. When the rock drill was complete, we passed out cap pistols to all of the infantry commanders and told them to take up positions on the opposing hills. Caps are better than blanks for a staff ride because they do not require permits for transporting Class V supplies, nor do they have security requirements like weapons.

On signal, the engineer actors walked the route of attack, simulating the tunnel that Union engineers dug under the parapets. With the wave of a flag, they signaled that the parapet was blown, and the infantrymen rushed forward, firing their pistols. Both sides stood on the remains of the actual parapet and engaged for several minutes. Finally, on the commander's order, the Union actors withdrew.

The result was fantastic. Everyone in the group spoke about what a great tour it was. Even the battalion commander fired off blanks like an old cavalry commander.

Conclusion

Don't forget that the main purpose of a staff ride is to experience a battle from the perspective of a commander or soldier on the ground, regardless of your military branch or research experience. However, another purpose is to have fun. Don't become sidetracked. A staff ride should be a reward to a unit that has worked and trained hard and deserves a chance to get away from "the mill" for a few days. Don't think of a staff ride as just being more work. Think of it as a chance to train out of the ordinary. With a little planning, you are sure to have a winning training event. Even if you repeat it year after year, your unit will still benefit each time.

Captain Hynes is attending the Korean Language Center at Sogang University, Seoul, Korea, as a foreign-area officer. He previously commanded HHC, 307th Engineer Battalion, 82d Airborne Division, at Fort Bragg, North Carolina, and served as the battalion S3 officer during the preparation for the staff ride. A graduate of the United States Military Academy, CPT Hynes holds a master's degree in engineering management from the University of Missouri-Rolla.

Reference:

Robertson, William G., *The Staff Ride*. United States Army Center of Military History, Washington, D.C., 1987.

Libby Bridge Staff Ride

By Second Lieutenant James A. Westgate

Recently, officers of the 44th Engineer Battalion at Camp Howze, Korea, and the 82d Engineer Company (CSE) at Camp Edwards participated in a staff ride to the Libby Bridge as part of the Broken Heart Battalion's Leader Development Program. The purpose of the staff ride was to present an actual wartime engineering challenge, discuss a possible solution, and then visit the terrain to see firsthand the types of challenges the 84th Engineer Construction Battalion (ECB), the "Conquerors of the Imjin," experienced while building the Libby Bridge.

During the last two years of the Korean War, U.S. Army engineers dealt with the difficult task of bridging the Imjin River in the Eighth U.S. Army sector. Many float bridges and more substantial timber-trestle structures were destroyed during the summer flood season. By the fall of 1952, I Corps faced the winter with no bridges across the Imjin to support its divisions in combat along the front lines. Engineers of the 84th ECB made a significant contribution to the Eighth Army's effort by building the Libby and Teal Bridges across the Imjin in only 242 days.

Teal was a low-water bridge that could be used almost year-round, except during heavy rains. The Libby Bridge, the focus of the staff ride, was a much more substantial structure. Made of reinforced-concrete piers and steel-plate girders, it spanned 1,075 feet and could be used year-round to support a possible advance or an armistice. But, before the 84th ECB could begin construction, it had to overcome significant supply and personnel shortages. In addition, both bridges had to be built simultaneously before July 1953 by three line companies, which in October 1952 were spread between Seoul and the Freedom Gate Bridge working on other projects.

At the beginning of the staff ride, officers of the 44th Engineer Battalion received a preliminary briefing from the S3 on the timeline and plans prepared by the 2d Engineer Group for the construction of Libby Bridge. The focus of the brief was to point out the personnel shortages, equipment availability, logistical shortfalls, and engineering design challenges that confronted the 84th ECB during the various phases of the Libby Bridge construction. The officers learned that after conducting initial site preparation and receiving steel, wood, and other supplies from Japan, the 84th ECB worked through the winter to emplace the concrete caissons, build the reinforced-concrete piers, fabricate the steel-plate girders, and place the bridge deck. During the bridge construction, which was within artillery range of North Korea, the 84th ECB sustained two deaths. On 4 July 1953, Eighth Army commander General Maxwell Taylor dedicated the bridge, which was named after Sergeant George Libby, 3d Engineer Battalion, who earned the first Medal of Honor in the Korean War for actions near Taejon in July 1950.

For the officers of the 44th Engineer Battalion, the intent of the Libby Bridge staff ride was to foster an understanding, from the perspective of engineers facing a formidable construction task in a combat theater, of the hardships and challenges confronting engineers across the depth of the battlefield. Engineers of the 84th ECB completed their mission, drawing from the experiences they gained while fighting along the Imjin during the past year.

It is important to realize that no similar permanent fixed-bridging effort had ever been attempted in the history of the Corps by an engineer construction battalion in a combat theater—nor has it been done since. Today, nearly 50 years after its completion, the Libby Bridge still serves as a crossing site on the Imjin River. It stands as a symbol of the contributions that engineers have made—and continue to make—in support of maneuver units on the battlefield.

Second Lieutenant Westgate is the Assault and Obstacle Platoon leader for C/44th Engineer Battalion in Korea, where he previously served as A/S3. A graduate of the University of Texas at Austin with a degree in aerospace engineering, he has also completed the Engineer Officer Basic Course.

Chipyong-ni Staff Ride

By Major Keith A. Landry

On 11 February 2000, officers of the 44th Engineer Battalion at Camp Howze, Korea, participated in a staff ride to the battlefield at Chipyong-ni as part of the Broken Heart Battalion's Leader Development Program. The intent was to conduct a detailed case study of the direct and indirect leadership actions demonstrated by officers of the 23d Regimental Combat Team (RCT) during the battle of Chipyong-ni from 13 to15 February 1951. The 44th's commander wanted every officer to come away with a better understanding of what it takes to train, prepare, and motivate units and soldiers to fight—while surrounded and outnumbered—in Korea's severe winter environment and win.

In many annals, the siege of Chipyong-ni is described as one of the most bitterly contested engagements of the Korean War. Amid the snow-covered hills encircling the small town of Chipyong-ni in the X Corps sector, Colonel Paul Freeman's 23d RCT, 2d Infantry Division, made a decisive stand. During two long nights of brutal close combat, the 23d RCT—consisting of the regiment's three organic infantry battalions, the French battalion task organized with a Republic of Korea company, the 1st Ranger Company, an engineer company, a battalion of 105-millimeter howitzers, a battery of 155-millimeter howitzers, a company of 14 tanks, and 10 antiaircraft Quad 50s—inflicted tremendous casualties on elements of five attacking Chinese divisions. Chipyong-ni proved to be the culminating point of the Fourth Chinese Offensive and the Chinese Communist Forces' first operational defeat.

After a two-hour bus ride from Camp Howze, the officers began the staff ride at the Chipyong-ni battlefield monument (see photo) that was erected by the Korean 5th Infantry Division north of the village. Overlooking the village of Chipyong-ni, the A/44th officers set the stage for the tactical discussions to follow by providing an overview of the Korean War from 25 June 1950 up to Lieutenant General Ridgway's assumption of command of the Eighth U.S. Army in December 1950. Officers of B/44th provided an overview of the organization, capabilities, tactics, and limitations of the Chinese People's Liberation Army forces and the 23d RCT. Once the stage was set for understanding the political and military factors impacting on the battle, the 44th's commander led a discussion (on 14 February 2000) aimed at assessing the combat readiness of the Chinese Communist Force and the 23d RCT on in terms of morale, logistics, and training.

The officers then moved to the site of some of the fiercest fighting near the G/23d Infantry positions to continue the tactical discussion. The C/44th officers reviewed the actual battle of 13 to15 February 1951 to determine what leadership actions contributed significantly to the 23d RCT's success at Chipyong-ni. Finally, officers of HHC/44th analyzed the supply and maintenance challenges faced by the 23d RCT, to include the resupply options available to the unit. The staff ride ended with a discussion to assess the contribution of logistics to the victory at Chipyong-ni.

During the siege, the 23d RCT inflicted tremendous casualties on attacking Chinese Communist Forces and suffered 52 killed, 259 wounded, and 42 missing. For this action, the 23d RCT received the Presidential Unit Citation. Together, the officers of the 44th Engineer Battalion discovered that in the seven months between Task Force Smith's defeat near Suwon and the victory at Chipyong-ni, the U.S. Army had learned how to fight a numerically superior force on difficult terrain, at night, in a severe and logistically constrained environment and win.

As they walked off the battlefield, each officer from the 44th seemed to reflect on the contributions engineers make in support of maneuver units on the battlefield in Korea. It was a day well spent.

Major Landry is working on a Ph.D. in civil engineering at Rensselaer Polytechnic Institute in Troy, New York. He was previously the operations officer for the 44th Engineer Battalion, 2d Infantry Division, in Korea. MAJ Landry is a graduate of the United States Military Academy and the Command and General Staff College and is air-assault, airborne, and ranger qualified. MAJ Landry is a professional engineer in the state of Virginia.

UPGRADING THE MILLION-DOLLAR HOLE

By Captain Jonathan Gano

Each year, more than 8,000 engineer equipment operators and mechanics from all services train at Fort Leonard Wood—on more than 25 different models of equipment, totaling more than 700 vehicles. The 577th Engineer Battalion conducts most of this training at the Normandy Training Area (TA) 244, also known as the "million-dollar hole" because of the value of the equipment there. TA 244 is 900-plus acres that consist of 18 remote equipment-operation sites with a centralized hub of maintenance bays, maintenance-training facilities, and administrative buildings.

Unfortunately, many of the post's training areas need considerable work to bring them up to standard. To correct some of the shortcomings, the 1st Engineer Brigade initiated several projects for the most heavily used areas. The main focus is on TA 244, where 16 upgrades are planned for six of the sites that require varying degrees of the same basic improvements. These remote sites consist mostly of open, graded fields used for hands-on equipment-operation training. Typically, the equipment is parked in the mud or on a slightly improved gravel surface. Some of the sites have a small temporary or semi-permanent structure that is used for classroom instruction. These structures have portable latrines and trucked-in water.

These remote sites offer little in the way of protection from the elements. During cold weather, students now wait to operate equipment in tents with potbellied stoves or on uncovered bleachers. The 1st Engineer Brigade's proposed solution is to construct heated, pre-engineered buildings adjacent to equipment-operation sites. An example of such a structure is at Figure 1.

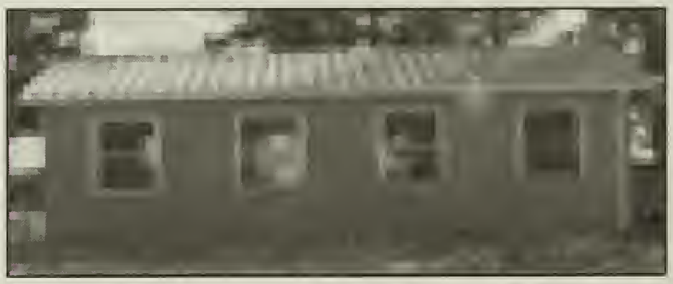


Figure 1

Currently, students sit on uncovered bleachers to observe training and receive safety briefings and instruction. The sunshade shown in Figure 2 would provide protection from the sun and rain.

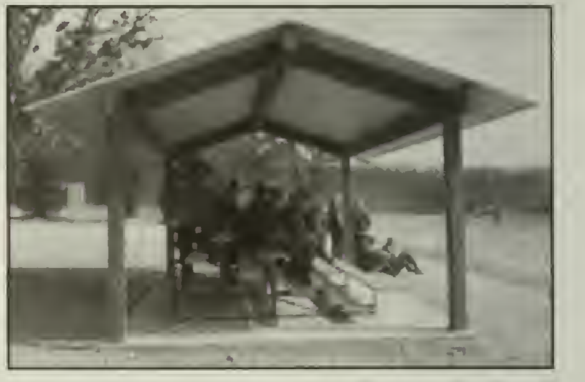


Figure 2

The solution to maintenance-facility shortfalls is to erect a "K-span" structure at each site. These semipermanent, arched buildings can house four pieces of equipment for a fraction of the cost of a conventional metal structure of similar size. Figure 3 illustrates a K-span structure already in use at the grader course.

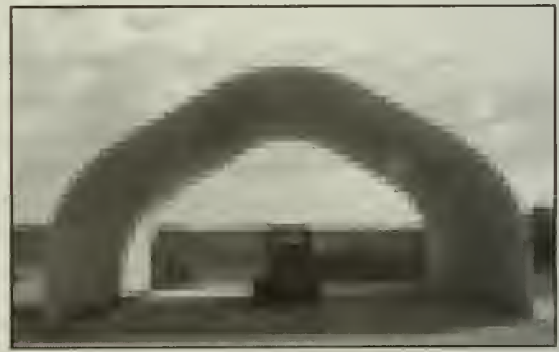


Figure 3

Relocating and refurbishing metal buildings from other locations on post will solve the problem of inadequate classroom space. The building in Figure 4 is large enough to accommodate two classrooms that satisfy Army design standards.

The 554th Engineer Battalion conducts a five-day field-training exercise for the Engineer Officer Basic Course (EOBC) at TA 221, also known as Fire-Support Base Thunder. This training area requires several projects to bring it to established training and safety standards. EOBC students will complete most of these projects as part of their field training. However,

Figure 4

some of the sites need external support, such as road construction and surfacing, surveying, and abutment construction. Figure 5 shows the site plan for TA 221.

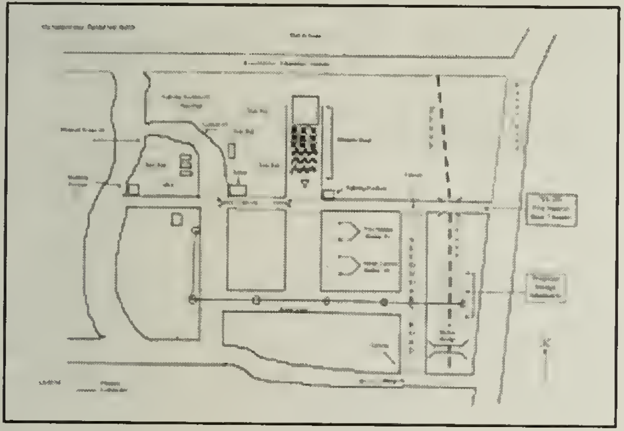


Figure 5

The one-station unit training units, the 35th and 169th Engineer Battalions, use TA 106 to conduct physical training, hand-to-hand combat, and end-of-cycle testing reinforcement. With some earthwork and simple construction, the area will accommodate a greater variety of training. It does not have a storage facility for training aids or an area for lane training. To expand the training opportunities of this area, a portion of the perimeter must be cleared and foxholes installed. The 1st Engineer Brigade's goal for TA 106 is to make it an all-encompassing site for basic combat training and refresher training for military occupational specialties 12B (combat engineer) and 12C (bridge crewman).

Some of these projects are within the capabilities of the 1st Engineer Brigade. However, due to the brigade's extensive training and support missions, it would take much longer to complete them using only internal assets. The 1st Engineer Brigade would like to offer the projects as training opportunities to other units, perhaps during their annual training. With prior coordination, interested units also can use the training ranges at Fort Leonard Wood. The post has reasonable billeting and mess arrangements that are available with proper coordination. Upon request, the brigade will provide a folder for each project described in this article. Units may view the bill of materials and project designs on the 1st Engineer Brigade's construction Web page at *http://www.wood.army.mil/1STBDE/construction*. Contact the brigade's operations officer at (573) 596-0223 or DSN 581-0223 for more details.

Captain Gano is a training developer in the Engineer Warfighter Division of the Directorate of Training Development, MANSCEN, Fort Leonard Wood, Missouri. Previous assignments include platoon leader and battalion maintenance officer, 40th Engineer Battalion, Baumholder, Germany; and Assistant S3, 1st Engineer Brigade, Fort Leonard Wood. CPT Gano is a graduate of the United States Military Academy.

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the imagery and geospatial community to 2005. The concept is currently under review with the Council of Colonels. The co-effort with the Intelligence School was generally accepted as the appropriate direction forward.

TeleEngineering

By Rose Acheson

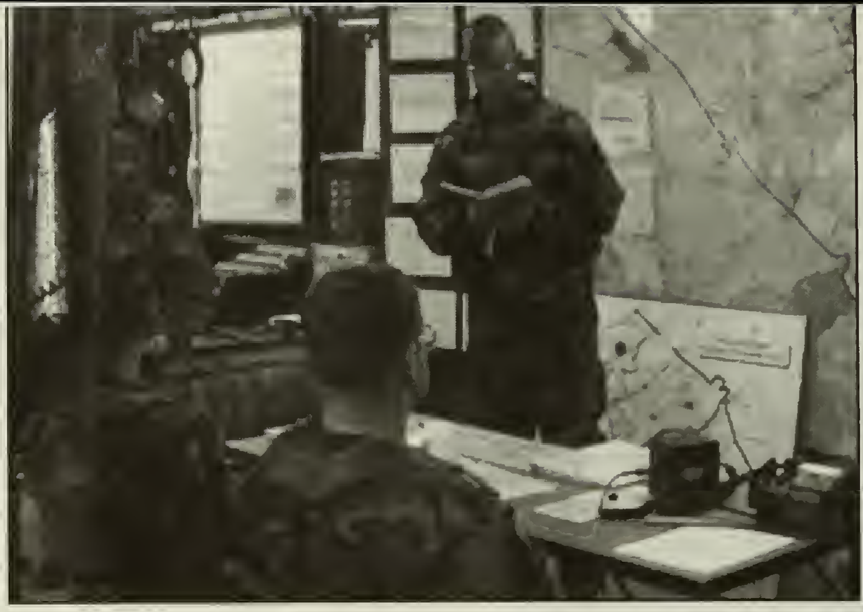
The session opened with an overview of the TeleEngineering program. TeleEngineering began as a technology demonstration to provide rapid solutions to the Department of Defense in support of maneuver engineering and force-support engineering using command-and-control architecture and existing communications systems. From the time of the Sava River flood, in 1997, to the present, the TeleEngineering Operations Center has provided more than 700 engineering solutions to requests for information that is not readily accessible in the field.

An example was given of a TeleEngineering capability—bridge assessment and repair. Several examples of damaged bridges were shown, and explanations were given on how the Engineer Research and Development Center helped identify the military load class of the damaged bridges.

Attendees also watched a short demonstration of the AntiTerrorist Planner (AT Planner), which is being developed to help engineer officers plan and implement measures required for force protection. Some comparative studies have been completed for air blast in urban areas. There are other tools for chemical and biological weapons, but they are not included in the AT Planner.

Conclusion

This year's breakout sessions provided an extremely valuable forum for senior leaders to discuss some of the most important subjects facing the Engineer Regiment. Some very important issues were raised and addressed. Session notes were forwarded to the DTLOMS integrator's office in the Engineer School for further action as necessary.



Deliberate River-Crossing Operations: *Focus on the Fundamentals*

By Lieutenant Colonel Miroslav P. Kurka and Major Brian Dosa

Combined-arms river crossings are complicated and difficult operations that require the commitment of substantial resources and a high degree of synchronization to be successful. This may be one of the reasons that maneuver forces infrequently train for river-crossing operations.

During its recent Warfighter Exercise, the 1st Cavalry Division (1CD)—with operational control of the 937th Engineer Group (Combat)—planned and executed a deliberate river crossing in a Korean scenario. In the process, both units thoroughly reviewed river-crossing doctrine as outlined in Field Manual (FM) 90-13, *River-Crossing Operations,* and developed useful tactics, techniques, and procedures (TTP) for executing and controlling division river-crossing operations. In the process, the 1CD combined-arms team reaffirmed the importance of the river-crossing fundamentals.

Preparation

The 1CD began preparing for the river crossing in early November 1999 during its Warfighter Seminar at Fort Leavenworth, Kansas. A major focus of this seminar was a doctrinal discussion of river-crossing operations by the division commanders and battlefield-operating-system chiefs. Additionally, the assistant division engineer, 1CD Engineer Brigade S3, and the 937th Engineer Group S3 compared and synchronized the tools that the division and group would use to plan and control the crossing operation. Foremost among these tools was a simple matrix (Figure 1) for tracking the progress of the crossing at each site.

In addition to tracking planned and actual crossing times, the matrix allowed the division and group to track the status of key bridging assets at each crossing site. The 1CD assistant division engineer developed a simple Microsoft® Excel program for calculating the engineer/bridging equipment and forces required to support a crossing operation. This program also calculated crossing times for both rafting and bridging, based on the number of vehicles to be crossed.

In December, the staff of the 937th Engineer Group deployed from Fort Riley, Kansas, to Fort Hood, Texas, to participate in a 1CD command post exercise (CPX). Before the CPX began, the 937th's staff conducted professional-development instruction on river-crossing operations by attending the III Corps training exercise "Road Runner 2000." A critical event during this exercise was the deliberate river crossing of Corps assets across Belton Lake, located adjacent to Fort Hood. The 62d Engineer Battalion commander and crossing force engineer (CFE) instructed the 937th's staff in the crossing area. Group officers conducted a terrain walk of the staging area, call-forward area, and engineer equipment park. The 74th Engineer Company (Multirole Bridge Company) emplaced the 120-meter assault-float ribbon bridge, and members of the 937th were able to walk across the bridge and learn the proper techniques of proofing the bridge before actually crossing as part of III Corps.

This river-crossing exercise provided excellent situational awareness for the 937th's staff and significantly enhanced their ability to plan and execute river crossings. During the December CPX, the 1CD and 937th planned a deliberate river-crossing operation. This crossing was not actually executed because the crossing force was able to execute a hasty crossing using

Crossing Site Arapaho

(BH77642740)

Assets Available: 1 AFB 957 2 AFB 957 1 MRB 299 2 MRB 299 1 AFB 814(+)

	Planned Order of Crossing	Actual Order of Crossing	Vehicles	# Raft Trips Required	Crossing Time (Hrs) 46 Trips/hr (10 Rafts) then 300 Veh/hr (2 Bridges)	Begin H +	End H +	Crossing Means	Cross Start Time	Cross Finish Time
Begin Preparatory Fires						34.00				
Begin Preparing Crossing Area						35.00	42.00	Rafting		
Dismounts Assault Across						36.00	37.00			
Begin Raft Construction						42.00	43.00			
Begin Rafting						43.00				
2BCT	TF 1-5 (-)		250	134	3.00	43.00	46.00			
	Transition To Bridging					46.00	47.00	Bridging		
	A/478EN		30	n/a	0.25	47.00	47.25			
	1-171 FA (MLRS)		223	n/a	0.75	47.25	48.00			
	A/3-82 FA		39	n/a	0.25	48.00	48.25			
	3-82 FA		128	n/a	0.50	48.25	48.75			
	1-158 FA (MLRS)		212	n/a	0.75	48.75	49.50			
	1-7 CAV		201	n/a	0.75	49.50	50.25			
	TF 2-12		209	n/a	0.75	50.25	51.00			
	HHC, 2 BCT		39	n/a	0.25	51.00	51.25			
	299 EN CO (MRB)		40	n/a	0.25	51.25	51.50			
	TF 1-12		195	n/a	0.75	51.50	52.25			
	91 ENGR		45	n/a	0.25	52.25	52.50			
	478 EN		50	n/a	0.25	52.50	52.75			
	1-21 FA (MLRS)		149	n/a	0.50	52.75	53.25			
	1-202 FA		149	n/a	0.50	53.25	53.75			
	2 x FLEs		170	n/a	0.75	53.75	54.50			
	DTAC		25	n/a	0.25	54.50	54.75			
	B/13 SIG (-)		60	n/a	0.25	54.75	55.00			

Slant: Interior Bays 80 / 80 Ramp Bays 30 / 30 Bridge Boats 35 / 35

AFB 536 m / 536 m Rafts 10 / 10

Figure 1

numerous ford sites. Despite this, the exercise provided valuable training for the staffs of the 1CD, the Engineer Brigade, and the 937th on river-crossing planning.

The 937th's headquarters returned to Fort Hood in late January 2000 for the 1CD Warfighter ramp-up CPX. During this exercise, the 1CD and the 937th conducted detailed planning for a deliberate crossing of the Yesong River in Korea, but once again did not execute a deliberate crossing. The opposing force (OPFOR) failed to destroy the bridge over the Yesong River, and the 1CD was able to cross the river over existing bridges. The division would not be so lucky when fighting the "world-class" OPFOR.

Planning and Rehearsals

On 22 February 2000, the 937th Engineer Group deployed to Fort Hood for the third and final time to support the 1CD during its Warfighter Exercise. Training objectives for this exercise were focused on the integration of the 937th into the 1CD, the development of plans and orders to fight in a Korean scenario, and command and control of engineers in support of a deliberate river crossing. The 1CD Warfighter scenario had the division attacking north into "Orangeland" on the Korean peninsula as the supporting effort of the U.S. III Corps. A major obstacle in the 1CD's zone was the Yesong River, which was 200 to 240 meters wide and fordable only in the eastern 25 percent of the division's zone. To support a deliberate crossing of the Yesong, III Corps allocated the 937th Engineer Group two corps combat-engineer battalions (one wheeled and one mechanized) and four bridge companies (one assault-float-bridge company and three multirole bridge companies) to the 1CD.

Using terrain products provided by the 1CD's terrain team, the assistant division engineer identified 14 potential crossing sites over the Yesong River in the 1CD attack zone: four fords, four fixed-bridge sites, two assault-float-bridge sites, and four rafting sites. The Yesong crossing sites are shown in Figure 2, page 30.

Working with the battle staff, the assistant division engineer developed a synchronized deliberate river-crossing plan with two crossing areas—the 2d Brigade Combat Team (2BCT) in

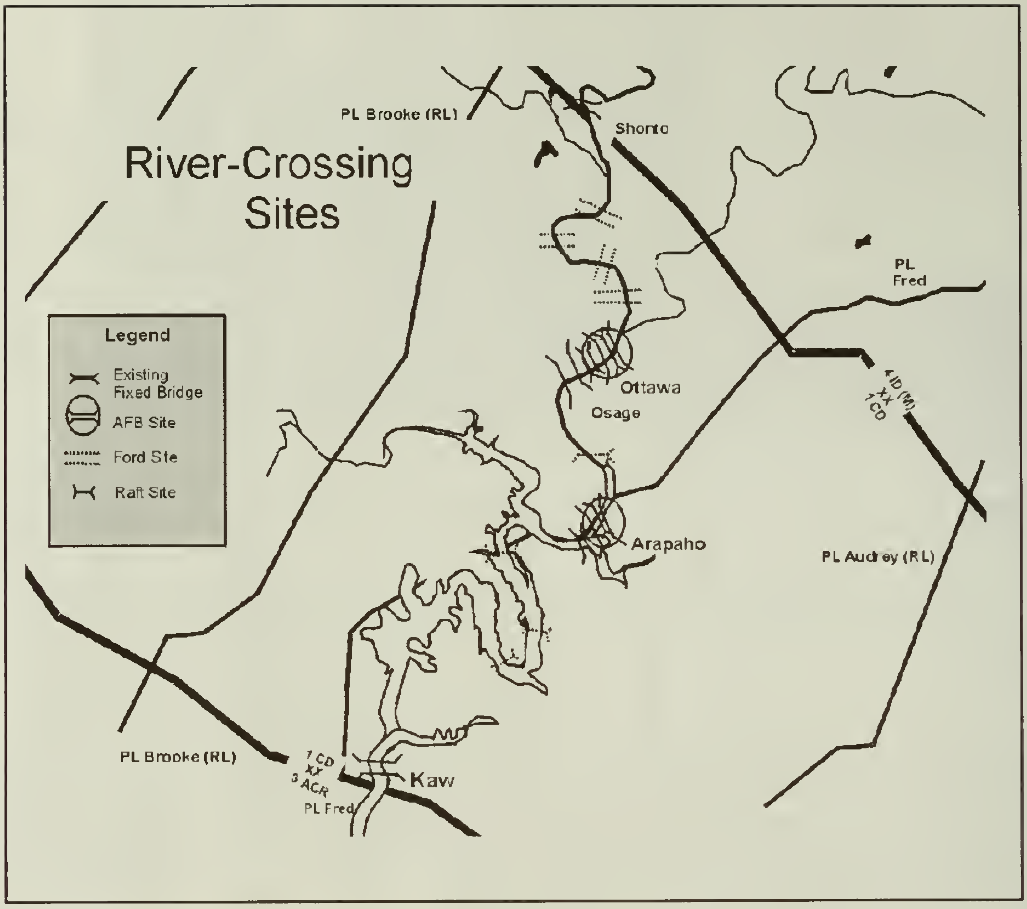


Figure 2

the west and the 1BCT in the east. The division maneuver and fire-support plan detailed all four phases of the river crossing:

- **Phase I.** Advance to the river.
- **Phase II.** Assault across the river.
- **Phase III.** Advance from the exit bank.
- **Phase IV.** Secure the bridgehead line.

Although the 1CD's engineer plan also focused on all four phases of the crossing, the division's river-crossing annex focused only on the first three phases. The plan called for two bridging sites—Arapaho in the west and Ottawa in the east. Because ford sites were located in the east, the 1BCT would conduct its assault crossing (Phase II) over the fords and secure both the near and far shores with heavy maneuver forces before commencing bridging operations at the Ottawa crossing site. Therefore, no rafting was planned at Ottawa. No ford sites were available in the 2BCT zone of attack, and the division planned to conduct the assault phase at the Arapaho crossing site using dismounted infantry in 15-person rubber boats (RB-15s). After securing the far shore from direct fire, engineers would construct rafts and raft a mechanized task force across the Yesong to build combat power, allow the 2BCT to eliminate observed indirect fire, and then allow the 937th to construct bridges. The 1CD designated the assistant division commander for maneuver (ADC-M) as the crossing-force commander and the 937th commander as the crossing-force engineer. Figure 3 shows a sketch of the crossing plan.

Also located in the 2BCT zone of attack was the Kaw crossing site, an existing fixed bridge over the Yesong River Dam. If Orangeland forces destroyed the dam, the river would drain and become fordable in several locations. If it wasn't severely damaged or destroyed, it provided a high-speed crossing. Thus, it was expected that Orangeland forces would attempt to damage, but not destroy, the dam and use chemicals to prevent the 1CD from using it. The division commander directed that the 937th be prepared to repair the roadway of the Kaw Dam.

After receiving the 1CD operations order, the 937th began to develop a detailed crossing plan to support the maneuver plan. Using the military decision-making process outlined in FM 101-5, *Staff Organization and Operations*, the 937th's staff analyzed the mission, developed courses of action, conducted

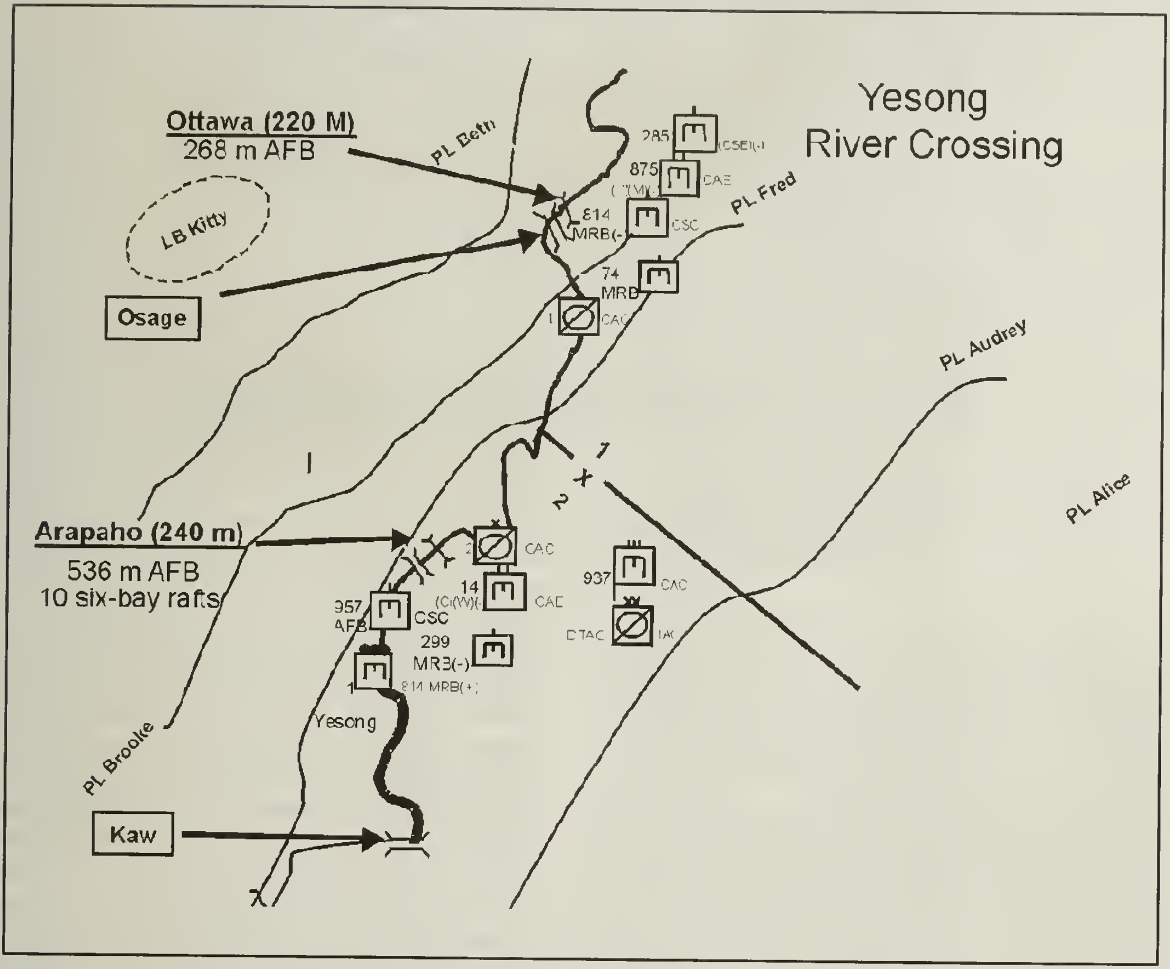


Figure 3

war gaming, and then compared courses of action. During its planning, the staff worked closely with the assistant division engineer and the 1CD Engineer Brigade staff. During its intelligence preparation of the battlefield, the 937th identified an additional crossing site just south of the Kaw Dam. Based on satellite imagery, it appeared to be a ford site. The 1CD Cavalry Squadron (1-7 Cavalry) was given the mission to reconnoiter this site. The 937th's plan refined and completed the initial division-crossing plan and was incorporated into the overall plan.

As part of the planning process, the division conducted a combined-arms synchronization drill and a detailed combined-arms rehearsal for the deliberate river crossing. A key element of both the synchronization drill and the rehearsal was the development of a battlefield-operating-system checklist (Figure 4, page 32) to ensure that the conditions for a deliberate crossing were set. This checklist used the principles of suppress, obscure, secure, and reduce to ensure that conditions were set before the river crossing began.

Suppress. During the advance to the river (Phase I), a two-hour preparation by the 1CD division artillery (DIVARTY) focused on key command-and-control elements, enemy forces at the river, and divisional and regimental artillery groups that could range the river.

Obscure. Smoke would be used in all four phases of the crossing. In addition to the BCTs' smoke assets, the 937th Engineer Group was allocated a dual-purpose chemical company to provide mechanical smoke for the movement to the river and the crossing operations. Although the 1CD did not plan a deception operation for the river crossing, a detailed smoke plan obscured the location of bridge assets during the advance to the river and obscured the location of actual assault, bridge, and raft sites during crossing operations.

Secure. Before the assault crossing, the near shore must be secured. The 1CD planned to accomplished this with a mechanized task force. Dismounted infantrymen would then assault across the river in RB-15s to secure and clear the far shore (Phase II). Additionally, air-defense-artillery coverage

River-Crossing Conditions

Conditions Met	Arapaho	Ottawa
Suppress		
Artillery preparation		
Obscure		
Wind data updated		
FA/mechanical smoke delivered		
Secure		
Near shore secured		
- Local security		
- CFZs activated		
- ADA umbrella in place		
Far shore secured		
- Direct and observed indirect fires eliminated		
Reduce		
Crossing area established		
Sufficient bridge assets available		
Decontamination sites confirmed		
COSCOM FLE STX established		

Figure 4

was required. The 937th Engineer Group was task-organized with an Avenger battery to provide short-range air defense. Patriots from III Corps (general support to the 1CD) were to provide high-to-medium-altitude air defense (HIMAD). Critical friendly zones were also established over the crossing area.

Reduce. Once the threat of direct fire was eliminated, bridge companies would move forward to construct six-bay rafts, with local security provided by infantrymen. Rafts would then move combat vehicles across the river to secure the far-shore objective and eliminate the threat of observed indirect fire. Once the threat of observed indirect fire was eliminated, bridging could begin. The crossing-area engineers (14th Engineer Battalion [Combat] [W] in the west and 875th Engineer Battalion [Combat] [M] in the east) would establish the crossing areas to support rafting and bridging operations. Chemical-decontamination sites and a 13th Corps Support Command forward logistics element were planned to support the crossing.

The river-crossing-conditions checklist was used by the crossing-force commander in the division tactical command post (DTAC) and the BCT and 937th command posts.

Execution

The division crossed the line of departure at H-hour (292000 February) with the 1BCT (main effort in the east) and the 2BCT (supporting effort in the west) attacking to destroy Orangeland forces in the zone. The 3BCT mission was to follow the 1BCT and, on order, assume its mission. The 1-7 Cavalry was forward conducting zone reconnaissance to identify the 1st tactical echelon's main defenses and allow the lead BCTs to retain combat power. The 937th Engineer Group was divided into two task forces (Pioneer West and East) to support the crossings at Arapaho and Ottawa respectively. These task forces were under operations control for movement of the two lead BCTs. Based on the war gaming, the river crossing at Arapaho was expected to occur at H+36.

Based on a clearer picture of the Orangeland force's dispositions and obstacles along the high-speed avenue of approach leading to Arapaho crossing site, the 937th commander and the 1CD division engineer (DIVEN) commander discussed alternatives for the 2BCT's crossing site in the west. The 1-7 Cavalry reported that the bridge over the dam at Kaw had been damaged and confirmed that the sites south of the dam could be used for rafting and bridging operations. In addition, Orangeland forces in that area appeared to be vulnerable, since they were massing their defense in the center and east. A crossing south of Kaw would surprise the OPFOR. The 1CD DIVEN commander recommended to the ADC-M at approximately H+26 that the 2BCT cross at the site south of Kaw; this recommendation was approved. That evening, the DIVEN S3 and the S3 of the 937th helped write a 1CD fragmentary order that directed the 2BCT to cross at Kaw and provided new crossing control measures.

The 2BCT received the 1CD fragmentary order on the move and prepared to cross at the new site, which demonstrated a high degree of flexibility. The 937th's liaison officer to the 2BCT proved invaluable at this point by helping to adjust the plan. The 2BCT arrived at the river at H+36 and reported that the near shore was secure. At the same time, the 1CD DIVARTY executed preparatory fires and reported that critical friendly zones were established over the crossing area. After the DTAC received reports that all crossing conditions were set, the crossing-force commander directed the 2BCT to conduct the assault crossing.

When the far shore was reported secured, Task Force Pioneer West moved to the river, began to construct six-bay rafts, and then began to raft tanks and Bradleys to the far shore. Due to a report that Orangeland's tank forces were preparing to counterattack the crossing area, the decision was made to transition to bridging early to build combat power on the far shore quicker. Emphasizing the fundamental of speed, Task Force Pioneer West rapidly built a ribbon bridge, while continuing rafting operations at the Kaw site, and crossed two task forces before the OPFOR destroyed the bridge with massed rocket artillery and close air support.

A bypassed Orangeland special-forces team on the near shore observed and directed accurate artillery and close air support to destroy the bridge. During the after-action review, it was determined that the critical friendly zones had not been set properly and that the HIMAD coverage was inadequate. This action demonstrated that clearing the near- and far-shore lodgments is a tenuous and difficult task. One lone OPFOR with a radio is the most dangerous person in the crossing area. In an effort to take advantage of the surprise created by the virtually unopposed crossing at Kaw, the division accepted risk by not absolutely ensuring that the crossing site was secure from observed indirect fire before beginning bridging operations. This allowed the division to quickly cross two mechanized task forces but left the ribbon bridge at Kaw vulnerable. Although the OPFOR destroyed this bridge, Task Force Pioneer West salvaged enough bridge assets to continue rafting until both near and far shores were fully secure and the threat of direct and observed indirect fire was eliminated. Crossing operations at Kaw were disrupted and delayed, but they were not eliminated. The 2BCT continued to build combat power on the far shore and eventually secured the bridgehead line.

Conclusions

The 1CD Warfighter Exercise provided excellent training on planning and conducting river-crossing operations at the division level. The exercise also reinforced the crossing fundamentals outlined in FM 90-13.

Surprise. Because it planned a persistent chemical attack on the Kaw Dam, the OPFOR was not expecting a deliberate crossing in the vicinity. The 2BCT conducted a virtually unopposed crossing at Kaw (south of the chemically contaminated zone) and rapidly built combat power on the far shore by surprising the OPFOR.

Extensive Preparation. Preparation for crossing at Kaw began with the 1CD Warfighter Seminar in November and continued for four months. Preparation included assembling tools, developing TTP, analyzing intelligence, planning, and rehearsing. This preparation allowed the 1CD and the 937th to have a common and thorough understanding of river-crossing operations and execute them rapidly, even though the environment was confused and hostile.

Flexible Plan. The 1CD crossing plan included all 14 potential crossing sites. Staging areas, call-forward areas, and routes were located to allow a rapid shifting of crossing assets from one site to another. This flexible plan allowed the division to shift its main crossing effort from the Arapaho to the Kaw site in less than 10 hours.

Traffic Control. An extensive traffic-control plan, which included military police to operate traffic-control points at all major intersections and all staging and call-forward areas, was incorporated into the 1CD crossing plan. The plan also included holding areas and extensive lateral routes to allow traffic to be shifted off congested routes.

Organization. The 1CD river crossing at the Kaw site was a combined-arms operation commanded and controlled by the ADC-M from the DTAC. The crossing force combined all battlefield-operating-system elements and focused its efforts on the enemy and tactical tasks on the far side of the river. All operations were synchronized at both the 2BCT tactical operations center (the crossing-area command headquarters) and the DTAC (the crossing-force command headquarters). The one asset not directly under division control was HIMAD coverage. The Patriot battery that was to provide this coverage was in general support to the division. This lack of control contributed to ineffective HIMAD coverage at the Kaw crossing site and the loss of a bridge.

Speed. The requirement to build combat power on the far shore is critical. In the case of the 1CD crossing at Kaw, however, the desire for speed caused the crossing force to lose tactical patience and transition to rafting and bridging before all conditions had been met. Most importantly, in the rush to get combat power across the river, critical friendly zones were not fully established over the crossing area (resulting in ineffective response to enemy rocket-artillery attacks), and all enemy artillery observers were not eliminated from the crossing area. The rush to transition to bridging resulted in the loss of numerous bridge assets that might have survived had rafting continued.

Combined-arms river crossings are complicated and difficult operations. Organizations that want to be proficient at river crossing must devote substantial training resources, most notably time, to ensure the high degree of synchronization required for success. The recent 1st Cavalry Division Warfighter Exercise provided both the division and the 937th Engineer Group (Combat) the opportunity to train extensively and develop useful TTP for executing and controlling crossing operations.

Lieutenant Colonel Kurka commands the 1st Engineer Battalion (Combat), Fort Riley, Kansas. He previously was the executive officer of the 937th Engineer Group (Combat) at Fort Riley, and commander of the 565th Engineer Battalion (Provisional) in Hanau, Germany. LTC Kurka is a graduate of the United States Military Academy, Central Michigan University, and the Command and General Staff College.

Major Dosa is the XO of the 70th Engineer Battalion, Fort Riley, Kansas. He was previously the S3 of the 937th Engineer Group (Combat) at Fort Riley. He is a graduate of the United States Military Academy and the Command and General Staff College and holds a master's degree in civil and environmental engineering from Cornell University. MAJ Dosa is a professional engineer in Delaware and Pennsylvania.

TACOM Sets the DEUCE Loose

By Rae Higgins

The U.S. Army Tank-automotive and Armaments Command has given some of the Army's elite, "high-speed" engineers something to say "hooah" about — a new, and equally high-speed, high-tech dozer. The deployable universal combat earthmover (DEUCE) is a state-of-the art dozer that promises to set the combat-engineer community on its ear, as it represents a new concept in equipment use, crew comfort, training, and maintenance.

Light infantry units headquartered at Fort Drum, New York, and airborne units at Fort Bragg, North Carolina, were the first to be equipped with the new dozers last summer. Although the DEUCE is not yet slated for Armywide fielding, units at Fort Lewis, Washington, will receive a few DEUCEs to test in support of the initial brigade combat teams, as the Army marches forward on its plan for transformation.

The DEUCE enables light infantry and airborne engineers to prepare airstrips, roads, and protective positions, while keeping pace with the ground forces. The great thing about this dozer is that it doesn't have to be loaded and hauled from one combat construction site to the next. All the operator has to do is flip a dashboard switch to shift the dozer from the earthmoving mode into the self-deploy mode. And, to the delight of combat engineers everywhere, the DEUCE features an enclosed cab with heat and air conditioning.

Requirements

The Army's DEUCE program began in late 1992. According to TACOM's DEUCE system acquisition manager, the combat developer (the U.S. Army Engineer School) established the mission need for the DEUCE in an operational-requirements document (ORD). The DEUCE ORD states that "Engineers, as part of the light combined-arms team (organic or task-oriented to light divisions), need a light-weight earthmoving capability that does not require a prime mover and trailer for operational and tactical movement and is strategically deployable by air. The DEUCE must travel rapidly between job sites and travel across and on paved airfields and highways without damaging the surface."

TACOM's DEUCE team played a critical role in making the dozer a reality for engineers. When a combat developer expresses a need for a piece of equipment, TACOM's materiel developers procure equipment that can meet that need.

The 35,500-pound DEUCE is manufactured by Caterpillar®. TACOM wanted to capitalize on existing commercial components rather than introducing unique parts and achieved this goal by the nondevelopmental item integration of Caterpillar® commercial components. This resulted in only about 20 percent of the parts being DEUCE-unique.

Features

Three important features of the DEUCE are the—

- Ability to self-deploy.
- Six-way (power, angle, and tilt) blade.

DEUCEs like these allow light infantry and airborne engineers to keep up with ground forces. What's more, these air-dropped, self-deployable dozers don't have to be loaded and hauled from one combat construction site to the next.

- Electronically controlled engine/transmission combination.

The DEUCE, which can be ready to dig in less than a minute, replaces the D5 dozer in the light engineer forces. Its ability to switch into the self-deploy mode is a radical departure from dozers used in the past. It saves the time and manpower it used to take to load, haul, and unload dozers like the D5B, which was at least a two-person job. This self-deployability was a key operational factor. A lone DEUCE operator can move right into battle, complete his mission, and redeploy to the rear without relying on anyone or anything else to get him and the vehicle there and back.

In the earthmoving mode, an operator drives the DEUCE with standard power-shift transmission. This allows for the slow, high-torque drive required for dozing. Conversely, once he switches to the self-deploy mode, a six-speed automatic transmission kicks in, which enables the DEUCE to reach road speeds of 30 to 35 mph.

The DEUCE's hydraulic blade is different from "regular" dozer blades. It not only goes up and down but also can tilt left and right for "V-cuts" and can angle left and right. This flexibility gives an operator a variety of dozing options, depending on the task at hand. Moreover, hydraulic blades can significantly improve dozing times.

The DEUCE also sports rubber track. Steel track, which is the norm for most construction equipment, can damage roads by chewing up the asphalt.

The DEUCE was designed with the soldier-operator in mind. The enclosed, climate-controlled cab sets the stage for optimal operator performance—meaning the soldier at the wheel is less likely to become fatigued due to extreme weather conditions like oppressive heat and humidity or frigid cold. In addition, the vehicle features a seat that adjusts to the operator's height and weight, a hook-up for hydraulic tools, and a communication connection for radio and global positioning systems.

The DEUCE is also different from other dozers in that its controls are ergonomically designed, so operator-training requirements are kept to a minimum. Simply put, the DEUCE has a steering wheel, an accelerator, and brakes—much like a car. This is a big change from older tracked construction equipment that combat engineers use.

Maintenance

Dozer mechanics have reason to give the DEUCE high marks because of a new electronically controlled diagnostics system. The soldiers' portable on-systems repair tool (SPORT) signals a maintenance specialist of mechanical problems. The SPORT is a separate piece of equipment and is the Army's only authorized "ruggedized" laptop. Using the SPORT, a mechanic can simply plug in a standard tester to zero in on a problem. He doesn't have to crawl around the DEUCE to pinpoint maintenance issues.

The DEUCE is also compatible to hookup with the small emplacement excavator's hydraulic tools, including the pavement breaker, hammer drill, chain saw, impact wrench, and hose assembly.

Response to the new dozer has been positive. In November 1999, the Engineer School trained several soldiers, both operators and maintainers, from the 5th Engineer Battalion, who recently tried out two DEUCES at the National Training Center (NTC) at Fort Irwin, California. Their positive comments centered on ease of operation, plentiful power, ride comfort, and user-friendly maintainability at the operator level.

According to the experiment projects NCO at the Maneuver Support Battle Lab at Fort Leonard Wood, Missouri, the NTC's fearsome, fabled, and famous opposing force thought the DEUCE's mobility was good, but the digging time was slower than they would have liked. The operators realized that their lack of experience on the equipment was a factor in the slower digging time but, with more experience, digging times would improve.

The DEUCE performed well on reliability, mobility, and durability, but some modifications, such as a wider blade, will enhance its ability to perform required missions faster. However, a wider blade does not fit the transportability requirements.

Troops aren't the only ones who are becoming more familiar with the DEUCE's derring-do. When Secretary of the Army Louis Caldera came to Fort Leonard Wood last December, he visited Training Area 244, where operators from all services learn to run heavy-construction equipment. Secretary Caldera climbed into the driver's seat of a DEUCE, revved it up, and took it for a spin. He returned with a big smile on his face and said that he considered this chance to drive the DEUCE an early Christmas present.

Program Success

TACOM's dedication to making the DEUCE the best possible state-of-the-art piece of Army engineer construction equipment has, without a doubt, greatly added to the success of the program. In meeting the deployability (C-130 drive on/off, low velocity air-droppable) and mobility requirements (30-plus mph), the DEUCE has significantly enhanced capabilities that will shape the battlefield in its combat-engineer mission for Army XXI. The "creature-comfort" improvements, along with its operational features, make the DEUCE a unique piece of engineer equipment that is highly universal.

TACOM is currently on contract for 130 DEUCEs, but the system acquisition manager anticipates procuring a total of about 200 for the Active and Reserve Components. DEUCE fieldings will continue as scheduled through December 2001.

Ms. Higgins is a public affairs specialist assigned to Headquarters, U.S. Army Tank-automotive and Armaments Command, Warren, Michigan. She holds a bachelor's degree in communication from Oakland University, Rochester, Michigan, and is a graduate of the Defense Information School's Public Affairs Officer Course. She is also a member of the Public Relations Society of America.

Managing the Logistics-Support Contract in the Balkans Theater

By Colonel Donald T. Wynn

On 12 June 1999, U.S. forces moved into Kosovo in support of the NATO peacekeeping operation. That was the beginning of extremely intense operations by the total Engineer Regiment, which was composed of Army engineers, Seabees, Corps of Engineers civilians, and a Corps contractor (Brown & Root Services of Houston, Texas). In less than 90 days, the Regiment accomplished a minor miracle: It built enough Southeast Asia (SEA) huts (large plywood buildings based on a design originally used in Vietnam) to house Task Force Falcon through the bitter Balkans winter. Of course, the real winners were the men and women of the task force. The Regiment did not rest on its laurels but forged ahead to complete the base camps and establish an enviable quality of life for the American forces.

Brown & Root was a significant factor in the success of the Engineer Regiment and Task Force Falcon. This engineer success, combined with the requisite contracted logistics support, has clearly established a template for rapidly providing temporary facilities and services in future operations other than war.

Brown & Root's operational scope was large and diverse. From 12 June to 30 September 1999, the contractor provided 15,559 trusses and 7,222 sidewalls for SEA-hut construction (prefabricated in Macedonia and trucked to the Kosovo camps); assembled 192 SEA huts in conjunction with Army and Navy engineers; and erected two temporary (Tier III tents) dining facilities, 13 helipads, 2 aviation-maintenance clamshells, 12 temporary mess-kitchen-trailer dining facilities, and 37 temporary shower units. While Brown & Root supported this intensive temporary construction effort, it also supplied task-force members with logistics services that contributed immeasurably to troop morale and mission readiness: 1,134,182 high-quality meals, 55,544,000 gallons of water, and 383,071 gallons of diesel fuel (DF) 2. The contractor also serviced 671 portable latrines a total of 31,037 times, collected 89,228 cubic meters of trash, and loaded/offloaded 4,229 containers. These numbers represent a snapshot of some of the services provided by Brown & Root, but the list is by no means all-inclusive.

The Corps's Transatlantic Programs Center (TAC), on behalf of the U.S. Army Europe's Deputy Chief of Staff for Logistics (USAREUR DCSLOG), awarded and are administering the Brown & Root contract. The TAC receives extensive support from the Defense Contract Management Agency (DCMA), the Defense Contract Audit Agency (DCAA), and the Base Camp Coordinating Agency (BCCA). Simply put, these agencies' roles in overseeing the Brown & Root contract are as follows:

- The TAC provides the program management, funds control, and contracting-officer oversight.
- The DCMA provides the administrative contracting officers (ACOs) in the Balkans, along with quality-assurance and property-control teams. The teams are coordinated out of the DCMA's southern Europe headquarters. The DCMA also provides an ACO at Brown & Root's corporate headquarters to review and approve corporate functions related to the contract.
- The DCAA provides independent verification of all costs incurred by Brown & Root.
- The BCCA performs many of the same functions that are performed by the Directorate of Public Works at a regular Army installation, plus the BCCA assists the DCMA ACOs with assuring the quality of Brown & Root's construction. The current BCCA groups are provided by the Corps's North Atlantic Division and supervised by the Corps's Europe District.

With so many different organizations involved in the administration of one contract, intensive communications and coordination are required to ensure the smooth flow of logistics services to the task force.

Contracting in the Balkans

The numbers capturing Brown & Root's support to Task Force Falcon are impressive, even for the short time period mentioned above. However, the contractor has provided logistics services in the Balkans region since December 1995, when U.S. forces were committed to the NATO peacekeeping operation in Bosnia-Herzegovina. From then through May 1997, the services were provided under a contract awarded by TAC to support the Army's Logistics Civil Augmentation Program (LOGCAP), which provides contracted logistics services during military contingency operations. The Army expended $546.6 million for services supporting the peacekeeping operations in Bosnia.

As a result of the continuing U.S. commitment in Bosnia, USAREUR asked TAC to award a follow-on, sustainment-services contract to Brown & Root. This contract, with a value of $413.5 million, was effective from May 1997 through May 1999. The contract was not part of LOGCAP, which is now administered by the U.S. Army Materiel Command. (See article "LOGCAP: Providing Vital Services to Soldiers," *Engineer*, March 1997.)

The continued U.S. involvement in the Balkans region prompted the competitive award of the current logistics-support contract, which became effective in May 1999. The contract was awarded for one year, with four one-year option periods that can be awarded at the government's discretion. Services are provided for U.S. forces deployed to support—

- Operation Joint Forge, the U.S. portion of the NATO-led peacekeeping operation designed to help stabilize Bosnia following the 1995 Dayton Peace Accords. U.S. military units also support Joint Forge at locations in Hungary and Croatia.
- Operation Joint Guardian, the U.S. portion of the NATO-led military force whose aim is to achieve a secure environment to ensure peace and stability in Kosovo. U.S. military units also support Joint Guardian in neighboring Macedonia.

The contract is a cost-reimbursement, indefinite-delivery/indefinite-quantity contract, with task orders issued to the contractor to match customer requirements. This type of contract is used when the government cannot specify in advance a firm quantity of services because of changing mission requirements. Having this contractual flexibility has been a key element of providing logistics services in the Balkans, where mission requirements may change frequently. Additionally, the contract is structured so that it can be used to support other operations in the region at USAREUR DCSLOG's request.

From May 1999 through early April 2000, providing services cost in excess of $625 million. Most of that went for the intense build-up operations in Kosovo ($389.2 million) and Macedonia ($75 million), with the remainder supporting sustainment operations in Bosnia, Hungary, and Croatia ($161.6 million).

Deciding to Contract

TAC was requested by its customer to competitively award the current logistics-support contract because USAREUR DCSLOG determined that this contracting support is critical for meeting soldiers' needs in the theater. However, the genesis of providing contracted logistics services predates the Balkans operations by well over a decade.

SEA huts in Tuzla, Bosnia

Why did the Army decide to use a civilian contractor to provide logistics-support services to U.S. forces overseas? And what considerations, decisions, and requirements are required to manage a contract of this magnitude?

Obviously, the optimal solution to providing logistics services for any operation is to have a robust uniformed force structure in an unconstrained environment—a scenario that would give the field commander full control of his logistics assets. It's just as obvious that in today's constrained budget and force-structure environments, that scenario is extraordinarily unlikely. The Army envisioned these constraints in the 1980s, before the fall of the Berlin Wall and the Gulf War, and developed a plan that would use civilian contractors to augment the Army's logistics capability during contingency or wartime operations.

Since then, two factors have forced the Army to use contracted services even more heavily than originally envisioned: a greater-than-anticipated reduction in the force structure and the limited size of the military footprint in overseas military operations. Thus, the Army has come to rely heavily on contracted services in the areas of life support (food, water, shelter, sanitation, and laundry), transportation, and maintenance. This enables the footprint of U.S. forces to consist primarily of combat units.

As the Army began developing this plan, it reviewed industry's support of past military operations and looked at the potential for continued support. The 1980s and 1990s have

Brown & Root provides container-handling services for U.S. Army operations in Bosnia.

produced several robust corporations with extensive global networks. Prudently engaged, these corporations are prepared and practiced in independently delivering logistics-type services in a vast spectrum of environments and locations. This competitive environment places corporations in a position to respond rapidly to commercial needs which, in turn, can be extended to support the needs of combat soldiers in military missions around the world.

Whether supporting a large combat operation or an operation other than war, the logistics-support requirements are similar. In both cases, soldiers need food and shelter, transportation to and in the theater of operations, materials procured and delivered, and heavy equipment maintained. Contracted logistics provide field commanders with another tool for meeting these needs. If commanders are capped by force-structure limits, they can rely on a contractor that can hire people or award subcontracts to meet basic needs. Thus, field commanders have additional flexibility for accomplishing their mission.

With any military operation, the "five Ps" prevail: *Prior planning prevents poor performance.* The contractor must be integrated into the planning process, or major disconnects will occur during the military operation when it's time to deliver logistics support.

Selecting the Contract Type

When the Army asked the Corps of Engineers to manage the contracting effort for the LOGCAP, the first step was to determine the best contractual vehicle for this logistics support. The Corps determined that a cost contract was the only vehicle flexible and responsive enough to meet the needs of maneuver commanders.

It is instructive to compare a cost contract to a fixed-price instrument. With a fixed-price contract, the price is known (fixed), because the scope of work is relatively well-detailed with no known pricing contingencies. With this much detail, the contractor assumes the cost and performance risks.

With a cost contract, the exact price is not known, because the government cannot completely define the scope of work. The government assumes the cost risk and negotiates an estimated price for the work. The government must pay the contractor until all services are performed or until available funds are expended. However, cost contracts require intensive oversight by the government to identify and constrain scope-of-work creep and cost growth in a timely manner.

In determining the contract type, the government *knew* it required immediate response from the contractor but could not define the scope of work and cost. The government *knew* that the variables would be different for each military operation: number of troops, length of deployment, and actual services required. Because of these variables, the government *knew* it could not apply a cookie-cutter approach to providing logistics support for overseas military operations.

The Corps not only determined that a cost-type contractual vehicle would best suit the needs but also that a self-sufficient contractor with a global presence was required, for the reasons stated earlier. Most critically, this contractor had to have the financial capacity to operate up to 60 days without reimbursement. Since the contractor must respond immediately to an undefined requirement, there was no time to fully define the scope of work nor set up complex financial systems *before* the start of services. Accordingly, the 60-day window allowed time for the cash flow to begin while delivering services immediately to our troops.

The Corps required a self-sufficient contractor for two other reasons:

- Since the Corps sought a contractor to provide this capability, there would be minimal assistance from the government in executing the contractual requirements.
- The contractor would need to develop its own lines of communication and supply and maximize the use of commercial seaports and airfields. This is critical when the government's lift capabilities are consumed in moving the maneuver force into the area of operations.

The Corps developed a generic scope of work for contract performance with five major areas of effort: develop facilities, run supply operations, provide life-support services, perform maintenance, and provide transportation services.

These deliverables have remained constant in the three logistics-support contracts managed by the TAC, two of which have supported Balkans operations solely. In all instances, the

Aerial view of Camp Bondsteel, Kosovo

field commander determines the level of contracted support. Often, as the military footprint reduces during an operation, the contractor will step in to provide still-needed support services. These may include flight-line operations; fire fighting; and reception, staging, and onward movement. While the scope of work was generic, it was written to provide maximum flexibility in meeting the logistics needs—from the basics that have been mentioned to other services, such as mortuary and environmental.

Cost-type contracts carry a number of implications. The government must reimburse all costs incurred by the contractor during the contract performance, provided certain conditions are met; the costs must be reasonable, allocable, and allowable.

- A cost is reasonable if it does not exceed that which a prudent person would incur while conducting a competitive business. What is reasonable depends on a variety of considerations, including whether the cost is recognized as ordinary and necessary for conducting business or for performing tasks under the contract. Does the work meet acceptable sound business practices? Does it meet federal and state laws and regulations? Does the work significantly deviate from the contractor's established practices?
- A cost is allocable if it is incurred specifically for the contract or if it is necessary to the overall operation of the business.
- A cost is allowable if it is reasonable, allocable, meets the terms of the contract, and is not specifically disallowable. Some examples of disallowable costs are those incurred for entertainment, fines and penalties, lobbying, and political activities.

Another critical component of a cost contract is the fee or profit. Within the Department of Defense contracting laws, options exist for these fee payments. A cost contract may have—

- A base fee, no matter how the contractor performs.
- An incentive fee, where the contractor and government have a target cost, and the fee is adjusted up or down based on how close the contractor is to the target.
- An award fee, which is a subjective fee based on a performance evaluation.

The Corps chose to have a low base fee (1 percent) with a higher award fee as an incentive for outstanding performance. Thus, the contractor can earn up to an 8 percent award fee for premium performance. The Corps, in conjunction with the customer (USAREUR DCSLOG), chose the 8 percent award fee to maximize performance.

The contractor is rated three times annually, using a numerical scoring system, with evaluation in three areas: cost control and funds management, performance, and flexibility and coordination. Participating in this process are the end users, the ACOs who direct the work in theater, the contracting officer in the TAC headquarters, and any other customers with significant interaction. The contractor must score above 70 percent to earn an award fee.

Using the Contract

A major concern of the joint-task-force commander is the command and control of the operational elements critical to mission success. In joint operational doctrine, the joint-task-force commander controls all aspects of the operations and the support necessary to ensure success. However, within U.S. military contracting regulations, authority to administer this type of logistics-support contract travels through the contracting chain of the contracting organization to the ACOs in the field. Hence, the operational control and contractual authorities for logistics support flow through two separate chains. They intersect in the theater of operations with the ACOs.

In a sense, the ACOs have two masters to serve. While they must support the task-force commander in the mission accomplishment, they also must administer the contract according to all appropriate laws and regulations. It is necessary that both the maneuver commander and contracting officers understand each others' roles and responsibilities and have an integrated process to resolve conflicts in mission requirements and contractual obligations.

Coordination is key. It is critical that the ACOs communicate directly and frequently with the task-force commander so that the contractual capabilities and the contracting officer's authorities are clearly understood by the maneuver forces. With so many participants, there's plenty of room for misunderstanding, especially in the harried days when a deployment is fresh. For that reason, working a logistics-support contractor into an exercise scenario is an extremely effective way of educating commanders on the capabilities and restrictions of the contractor. In circumstances where the contractor cannot be integrated into exercises, coordination becomes even more critical. Commanders involved with the contract must communicate frequently and fully to mitigate any possible disconnects.

Considering the Cost

Is the flexibility that the Army gains with the Brown & Root logistics-support contract worth the cost of that contract, considering that the Army has spent more than $600 million for contracted logistics support in Kosovo alone?

Advantages. While not an exact comparison, a study by the Logistics Management Institute (based on its examination of contracted logistics support in Bosnia) provides insight. The institute estimated that it would have taken 8,900 support troops to provide the same services that Brown & Root provided with some 6,700 employees for operations in Bosnia. As in previous operations, many of these employees were local nationals. Obviously, it is much cheaper to hire them than it is to keep a soldier on the books full-time with all the necessary support.

Using the logistics-support contract produces other benefits. It helps to avoid mobilizing large numbers of National Guard and Reserve units to support these aspects of deployment missions. In the area of foreign relations, hiring persons on the local economy provides several spin-offs. First, this action immediately starts pumping revenue into the depressed local economies, which in turn provides a favorable impression of the U.S. military presence. Second, with the number of U.S. military troops minimized, there is less of a perception that the country is being occupied.

Disadvantages. While contracting for logistics services provides several economic and political advantages, some drawbacks exist. The U.S. military recognizes and anticipates that contractors will continue to play a critical role on the battlefield; however, this heavy reliance does not necessarily mean that contracted support will be available in all cases. The Army must maintain a capability for operating without contracted logistics support. In a heavy combat environment, the ability of a contractor to move into and operate within the theater of operations will be severely restricted. Likewise, will the contractor be there in a full-scale war? How far can we extend the use of contractors in a hostile environment? And at what point does this option become nonviable?

Two other significant considerations merit mention: First, contracted logistics support requires intense contract administration because the cost risk is on the U.S. government. Second, the United States must provide security for the contractor. This is a recurring contentious issue; maneuver commanders do not want to use their limited combat structure to guard the contractor, and it is usually illegal for the contractor to hire its own security.

Applying Lessons Learned

There are some critical lessons learned from Kosovo that should be applied to subsequent operations. First, it is critical that all agencies and organizations understand their roles, responsibilities, and authorities in the administration of logistics-support contracts. This may be an obvious requirement; however, there is no written doctrine about this type of contract, so many individuals operate from inadequate knowledge or misperceptions generated by experience with fixed-price contracts. When at all possible, these relationships should be established in a working conference before the operation. Also, contracting officers must have considerable experience with cost-type contracts and must understand the fast-paced tempo of contingency operations.

Restrictions in the force structure and the military footprint in many overseas operations make using a logistics-support contractor like Brown & Root almost mandatory. All parties gain by this relationship. The United States is able to leverage the global presence and capabilities of large robust corporations and limit the amount of forces it must devote to the logistical tail of an operation. Corporations gain a very reliable customer (albeit a sometimes difficult one) with a healthy workload. U.S. forces gain an acceptable quality of life at a reasonable cost. The citizens of the United States gain more effective and efficient armed forces supporting democracy around the world.

Colonel Wynn commands the Transatlantic Program Center, U.S. Army Corps of Engineers, Winchester, Virginia. Other Corps assignments include tours with the Seattle, Far East, Honolulu, and Riyadh Districts. He also has served in Korea, Thailand, Honduras, Hawaii, and Saudi Arabia. COL Wynn holds two master of science degrees, one from the University of California at Davis and the other from the Naval War College; and a master of business administration degree from Long Island University. He is a licensed professional engineer in Virginia.

Battlefield Commission Awarded for Engineer Bridge Reconnaissance

By Captain (Retired) Wallace Fiedler

On 18 February 1951, General Matthew Ridgway summoned his staff to the G3 operations tent at his frontline Eighth U.S. Army headquarters. He announced that Eighth Army would attack the Chinese Communist Forces within 60 hours in an offensive called "Operation Killer."

At the time, I was the engineer reconnaissance-section sergeant for the 10th Engineer Combat Battalion of the U.S. 3d Infantry Division in I Corps. My team conducted all of the special ground and aerial combat-engineer reconnaissance for the 3d Infantry Division. The troops in the I Corps area were getting ready to launch their assigned missions for Operation Killer. This would take us into the Iron Triangle—made up of Chorwon on the west, Kumhwa on the east, and Pyonggang as the apex of the triangle.

The problem for I Corps was that the route went through the city of Seoul, the South Korean capital, which was across the Han River. The river's high tides caused engineers major floating-bridge problems. Although there were three highway bridges in Seoul that were still intact, we suspected that they were prepared for demolition. Since there was no way to bypass them, engineers would have to bridge the gaps if they were destroyed so armored vehicles could cross.

United Nations strategic intelligence reports indicated that about 18,000 Chinese Communist 50th Army troops were in Seoul, in addition to about 19,000 troops from the North Korean 8th and 47th Infantry Divisions and 47th Mechanized Division. When I was assigned to the assistant-division-engineer section at the 3d Infantry Division advanced command post (before I became the engineer reconnaissance-section sergeant), I attended many of the G2 intelligence and G3 operations briefings. So I was familiar with the big picture.

The 15th Regiment of the 3d Infantry Division was assigned the route that crossed the three bridges going through Seoul to the Iron Triangle area by way of Uijongbu, Yongpyong, and Kumhwa. The 15th Regiment kept sending combat patrols across the Han River at low tide to reconnoiter the bridges, but they always were turned back by heavy enemy defense fire. Meanwhile, I was conducting special aerial reconnaissance by getting rides in the artillery spotter planes. Because of the narrow valleys between the steep hills, the pilots could not get close enough for me to see if the bridges were prepared for demolition or if the banks and road approaches were mined. The planes flying photoreconnaissance flights were not able to get good pictures either.

According to United Nations intelligence reports, the Chinese Communist Forces and the North Korean People's Army were receiving strategic and tactical advice from the East Germans. I decided that if the East German soldiers were advising the Chinese and North Koreans about American combat tactics, there was a good chance I could reconnoiter the three bridges and get the information needed to decide if the main attack force could go through the city of Seoul or if it would have to take the more mountainous route farther east.

I had been a combat-engineer reconnaissance scout with the 297th Engineer Combat Battalion in Europe from the time of the Normandy invasion until we met the Russians at the Torgau Bridge on the Elbe River. We learned that if we could get through the German minefields, we probably could get to our objective. Therefore, I hoped and expected that the East German advisors, hoping to find out what I was looking for, would tell the Chinese and North Koreans to let me go through.

I knew that to get the information on the three bridges, I would have to cross the Han River at Seoul. But to get back, it would be better to come out at the bombed-out railroad bridge in the southwest part of the city in the U.S. Army 7th Infantry Division sector.

On 19 February, I checked the U.S. Geodetic Survey manual to see what time low tide would be for the Han River that day and had my recon scout and jeep driver get our two-man reconnaissance boat. We took off for the river below the big stone dike where I knew, from maps and aerial reconnaissance, that there was a T-junction at a main highway. When we got to the river, we inflated all of the compartments of the recon boat, which made all of us dizzy. The three of us got into the small boat and crossed to the big stone dike. A few North Korean or Chinese soldiers shot at us as we crossed the river, but none of their bullets hit us.

I got out of the boat with a Polaroid® camera, a wire cutter, and some tags with wire ties. I didn't take a weapon. I told the driver to take the jeep and go to where the railroad bridge crossed the Han River in the U.S. 7th Infantry Division sector and wait for me to come out there. I instructed the scout to leave the boat inflated and put it in the jeep. I also told him to not go back by way of the battalion S2 section but to wait for me at the railroad bridge. That was the first time that either of them knew what I intended to do on this recon mission. I had given them separate instructions, so if one couldn't make it, the other was to continue on to the railway bridge.

I climbed over the big stone dike and went down to the street below, which was the highway that went along the dike, then straight up the T-junction that led to the first bridge. When I got to the bridge, I saw a lot of Russian picric-acid antitank box mines on the highway that were not dug in or covered up. I flipped open the wooden lids, took out the detonators, and threw them into the snow on the rice paddy along the highway.

After taking a picture of the bridge from the friendly side toward the enemy side, I cut a length of communication (commo) wire that we had laid during one of our previous times in Seoul, tied a rock to it, and let it down from the highest part of the bridge to get the height above the streambed. I rolled up the length of wire and tagged it as "Bridge #1." Then, I went down under the bridge to see if it had been prepared for demolition. Nothing had been done to it, and the three concrete stringers were still in good condition. I went up to the other side and took a picture from the enemy side looking across the bridge toward the friendly side.

I continued up the highway, going north through Seoul toward Uijongbu, to the next bridge, which was in the north part of the city. When I got there, I did the same as I had at the first bridge, tagging the rolled-up commo wire as "Bridge #2." After I took a picture across the bridge from the enemy side toward the friendly side, I started back down the highway to the third bridge, which was on another highway coming in from Inchon from the west.

While I was walking through the city, I never saw a single person. But I felt as if there were thousands of eyes looking at me all the time. As I approached the third bridge, I heard three loud reports that sounded like pistol shots. I stopped dead in my tracks. I heard the reports again, and then I realized they were the sounds of someone washing clothes. (The Koreans lay their clothes on rocks near the water and hit them with wooden paddles to get out the dirt.) I walked a little farther, and there were three women by a small pool near the bridge, apparently washing clothes. None of them looked at me—even as I was measuring the bridge height above the streambed and looking under the bridge for demolitions—and I did not acknowledge them. (I am sure they were women, but when I was in Germany, the Germans often had troops dressed as women who would work in the farmyards and fields so they could observe us. But with binoculars, we usually could see their army boots at the bottom of their dresses.)

After I finished reconnoitering the third bridge, I only had to get to the railroad bridge and be picked up in the reconnaissance boat. I began to think that if I was being watched, they might decide to take me now and see what intelligence information they could get.

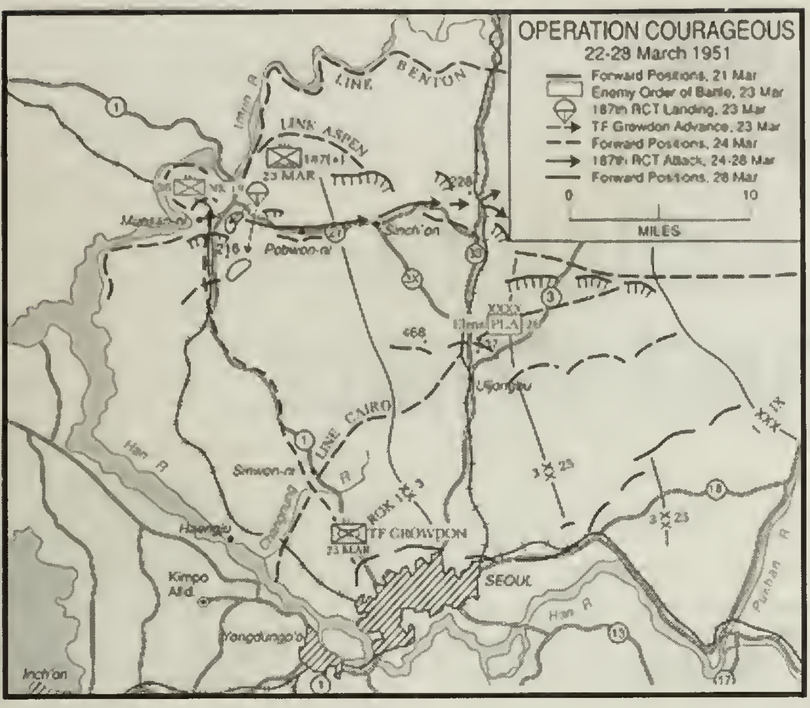
The railroad bridge was in sight. I felt that my recon team would be waiting for me across the river in the 7th Infantry Division sector, and I would soon be picked up. I had left the highway and was walking on the railroad tracks toward the end of the bombed-out bridge. The tide was coming in, and the Han River was already quite wide. About that time, I heard Pom! Pom! Pom! Pom! I realized I was being shot at by a Quad .50 on an M16 from our side of the river. I hit the side of the 6-foot steel I-beam of the bridge and started yelling for everyone that I could imagine might possibly be there, including my driver and scout. The Quad .50 started spitting out bullets again, but they were going way over my head. Finally, someone called out and asked if I was from the 3d Division. I said I was and that they should put the recon boat into the river and come and get me.

Engineers from the 7th Division came over with a motorboat to pick me up. No one had believed my driver and scout when they said I'd be coming out on the railroad bridge, and no one had told the Philippine soldiers on the M16 Quad .50 that someone friendly was supposed to be coming down the railroad tracks from inside the city.

It was late in the afternoon, and we still had to get back to the 10th Engineer Combat Battalion S2 intelligence section to turn in the information I had gathered. As we drove into the headquarters area, Captain Stanfield, the battalion S2, saw us arrive and wanted to know where we had been. At the same time, Colonel Gross came by and wanted to know what had happened to us. When I showed them the pictures I had taken of the bridges and the rolls of tagged wire, Colonel Gross said, "You've got to show them to the general right now!" (Major General Robert [Shorty] Soule was the 3d Division commander.)

We went to the 3d Division advanced command post, which was in a nearby school building. In the G2 intelligence room, I explained the pictures I had taken of the bridges and related them to the bridges on a large city map of Seoul. They asked questions about the road and street conditions and if I had seen any enemy troops, weapons, or materiel. The 3d Division G2 officer (a lieutenant colonel) told the general that he didn't believe I had actually been across the river and in the city of Seoul, even though I had the pictures of the bridges and the rolls of wire that measured the height of the bridge decks above the streambed.

Major General Soule asked Colonel Gross what he was going to do for this recon sergeant for getting this information. Colonel Gross told him that they planned to have me promoted to master



sergeant when it was time for me to rotate back to the States. "Master sergeant, hell!" General Soule retorted. "After this campaign, I want him to appear before the Battlefield Commission Board." Colonel Gross said to me, "That is a general's order, Fiedler, and you better obey it." I told them I would be there if I lived through the campaign, because I figured my mother would rather get a dead lieutenant shipped back home than a dead sergeant! (I really thought most of us would never rotate back to the States alive anyway.)

After leaving the 3d Division advanced command post, I went back to our battalion S2 tent to make out my report of the bridge reconnaissance; albeit unauthorized, it was the reason for the recommendation for my battlefield commission award.

On the morning of 21 February 1951, Operation Killer was launched. The plan was to go around the city of Seoul, with the attacking forces converging north of the city on the highway to Uijongbu. There, a line was established to prepare for the next attack north across the 38th parallel.

The attack for the Iron Triangle and the territory north, designated Operation Ripper, began on 7 March in the U.S. 25th Infantry Division sector. Although the Chinese Communist Forces and the North Korean People's Army put up some resistance, the real enemy was the early rains and warmer weather. It melted the ice and snow and made it necessary for engineers in particular to do lots of road and bridgework.

On 15 March, General Ridgway received word that there was a lot of dissatisfaction with the terms "Operation Killer" and "Operation Ripper" in stateside magazines and newspapers. The general said that he didn't understand why it was objectionable to acknowledge the fact that war was concerned with killing the enemy. However, he combined the two operations, and they continued under the name "Operation Courageous."

By 27 March 1951, all of the attacking United Nations troops were north of the 38th Parallel. South Korea had been cleared of Chinese Communist and North Korean troops for the second time. By 1 April, the combat phases of Operations Killer, Ripper, and Courageous ended. After the big push and all the battles it entailed, when we captured the towns of Chorwon, Kumhwa, and Pyonggang (the Iron Triangle) and Pyongyang (the abandoned capital of North Korea), we finally slowed down to routine combat-engineer assignments.

The Battlefield Commission Board convened at 3d Division rear headquarters in Seoul, Korea, on 22 June 1951. There, a cleaned-up group of troops in new fatigue uniforms was brought together to appear before the board. We certainly did not look like the "combat warriors" we were several months before. That evening there was a celebration banquet for us, and we were awarded our shiny second lieutenant or warrant officer bars. The next day, we were all flown to Tokyo, Japan, for 10 days of rest and recreation.

When Captain Fiedler returned to Korea, he became leader of the 1st Platoon, C Company, 10th Engineer Combat Battalion. From there, he went to Camp McCoy, Wisconsin, to become commander of C Company, 199th Engineer Combat Battalion. Later, the entire Engineer Combat Group was sent to Fort Leonard Wood, Missouri, to renovate large areas of the post for reopening. There, Captain Fiedler was the battalion S3 of the 199th Engineer Combat Battalion. He eventually retired at the Pentagon as a captain in the U.S. Army Corps of Engineers with a combination of more than 22 years active duty and more than 12 years active U.S. Army Reserve.

A Religious-Support Primer

By Chaplain (Major) Gregory K. Williamson

Our nation's constitution provides for individual religious freedom. In keeping with this constitutionally guaranteed right, the nation established the United States Chaplain Corps to minister to the diverse spiritual needs of those serving in uniform.

Every commander must ensure that soldiers are given the opportunity to worship and practice their religion according to the tenets of their faith. This normally means that soldiers are given time to worship, pray, and serve in their local synagogue, temple, church, or mosque. More narrowly speaking, it means that the commander establishes a plan of religious support within the unit.

Developing a Plan

The commander's staff officer for developing this plan is the chaplain. Every chaplain is professionally trained to function as a religious leader. Typically, but not always, the chaplain graduates from a seminary, serves a congregation for several years, and then comes on active duty under the auspices of a particular endorsing agency. The chaplain remains accountable to two authorities: ecclesiastical and military. He ministers according to the tenets of his faith and as the commander determines is best for his unit.

Within the context of personal religious conviction, unit needs, and the commander's wishes, the chaplain develops and recommends a religious-support plan. Each plan should be tailored to the religious composition of the unit, the commander's guidance, and the unit's mission. Typically, the plan evolves into a religious-support standing operating procedure for garrison operations and one for field operations. In addition, each operations order should address relevant and essential elements of religious support.

When developing a religious-support plan, the chaplain identifies the focus of religious activities. This focus should align itself with the phases of an order or mission. Before battle, the chaplain focuses on ministry to soldiers most likely to engage in combat operations. During battle, he focuses on ministry to wounded soldiers. Following combat operations, honoring the dead and ministering to the grieving is the focus.

A similar process is implemented for garrison operations. However, another component is added to the support plan: namely, family members. The chaplain, with the commander's guidance, must consciously decide where to focus ministry in garrison and determine when and where his religious-support assets are best applied. For instance, the commander may choose to have the chaplain perform home visits rather than visit a company on a range.

Elements of Support

To perform ministry effectively, the Unit Ministry Team (the chaplain and a chaplain's assistant) needs support from the commander and his or her staff. The four most significant elements of support—communication, transportation, information, and funding—greatly enhance the team's ability to provide quality ministry.

Communication. Whether in garrison or the field, the chaplain must be able to communicate with the units he is assigned to cover. In garrison, the chaplain needs a telephone and electronic mail; in the field, he needs a radio and a dedicated tactical telephone on the mobile-subscriber-equipment network. Commanders are best served by ensuring that their chaplains and chaplains' assistants are thoroughly trained in radio operations.

Transportation. To provide religious coverage, the unit chaplain must have appropriate transportation available. Chaplains need transportation resources to visit soldiers and their family members in their homes and while hospitalized, incarcerated, or convalescing. Most often, a sedan or van meets these needs. When in the field, the chaplain must have either a tactical vehicle assigned for his use or share access to a vehicle. In the latter case, the command group must establish clear priorities among users before deploying.

Information. Chaplains gather information to assess the moral and religious health and needs of soldiers, their family members, and the unit. The following information is relevant for this purpose, although it does not exhaust the possibilities: soldiers' religious preferences, marital status, dependents other than spouse, emergency leaves, hospitalizations, convalescence leaves, Red Cross messages, marriages and divorces, adverse actions, and blotter reports. After assessing these needs, the chaplain implements a religious-support plan and conducts ministry appropriate to them. Assessing and conducting ministry is not a "once-and-for-all" activity; rather, it is an ongoing process that must be done regularly and in response to particular situations.

Funding. The unit's Command Master Religious Plan (CMRP) incorporates funding for the unit's religious support. This document details programs and ministry that meet the religious and moral needs of the unit along with the estimated costs. Two funding sources are available to the chaplain: appropriated funds through the unit and nonappropriated funds through the consolidated chaplains' fund. A well-written CMRP serves both the commander and the chaplain as a tool for prioritizing ministry and funding for it.

Commanders' Needs

The above discussion presupposes that commanders themselves identify religious life as a training and unit priority. Furthermore, commanders may choose to seek the counsel of the unit chaplain for personal pastoral needs, such as prayer and meditation, or simply as a sympathetic ear to hear about the day's frustrations. As commanders seek out the chaplain for personal pastoral care, they will invigorate the religious and moral climate within their units, sending a message that none are beyond the need of encouragement, care, and comfort.

Chaplain (Major) Williamson was the senior Unit Ministry Team observer/controller at the Joint Readiness Training Center before his current assignment as group chaplain, 4th Psychological Operations Group (A), Fort Bragg, North Carolina.

The Engineer Writer's Guide

We think engineers take a special pride in their profession, and *Engineer* is always looking for articles from readers who want to share their expertise, experience, and ideas. If you are a potential contributing writer, here are a few tips to steer you in the right direction.

Articles may discuss engineer training, operations, doctrine, equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers, that's what we need.

Articles should generally come from contributors with firsthand experience of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words, and text should be double-spaced. Generally, each such page should contain from 200 to 250 words. Manuscripts should be originals or clear copies. Provide a 3 1/2-inch disk in Microsoft® Word, Rich Text Format, or ASCII (please indicate word-processing format on disk or cover letter). You also may send articles by e-mail to *bridgess@wood.army.mil.*

Articles containing attributable information or quotations not referenced in the story should carry appropriate endnotes.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint®, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint®.

Include your full name, rank, current unit, and job title. Also include a list of your past assignments, experiences, and education; your mailing address; and a fax number and commercial daytime phone number.

Reviews of books on engineer topics are also welcome.

Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 Engineer Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges, at DSN 676-5266, or commercial (573) 596-0131 ext. 3-5266. We look forward to hearing from you.

Note: Due to the limited space per issue, we will not print articles that have been accepted for publication by other Army professional bulletins.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Doctrine Development Division

Engineer Tactics, Techniques, and Procedures (TTP). Draft TTP available at *http://www.wood.army.mil/PUBS/ttps/engrttps.htm* are—

- Antipersonnel Obstacle-Breaching System (APOBS)
- Deployable Universal Combat Earthmover (DEUCE)
- Joint Rapid Airfield Construction (JRAC)
- Maneuver Control System-Engineer (MCS-E)
- Military John Deere GATOR (MGATOR)
- Mini Mine Detector (MIMID)
- Miniflail
- Robotic Military Operations in Urban Terrain (MOUT) Rubble Clearer
- Raptor
- Rapid Hardcopy Reproduction (RHR)
- Rapid Terrain Data Generation (RTDG)
- Skid Steer
- Selectable Lightweight Attack Munition (SLAM)
- Smart Mine Probe (SMP)
- Volcano Light
- Multipurpose Bunker

Deletion of Obsolete Publications. We have requested that several engineer publications be deleted from the Armywide inventory. The following publications are no longer valid for use by any Army component:

- TM 5-270, *Bridges, Cableways, Tramways and Suspension Bridges*
- TM 5-370, *Railroad Construction*
- TM 5-401, *Erection Procedures for Bldg, T-5 Arctic, Prefabricated, Panelized Wood, 20' x 48'*
- TM 5-402, *Erection Procedures for Bldg, Prefabricated, Ready Cut, Round Arch, Frigid, 20' x 48'*
- TM 5-744, *Structural Steelwork*
- TM 5-745, *Heating, Ventilation, Air-Conditioning and Sheetmetal Works*
- FM 5-488, *Logging and Sawmill Operations*

POC is LTC Harry Rossander, (573) 596-0131 ext. 3-7537, or DSN –7537, or e-mail *rossandh@wood.army.mil.*

The Army School System (TASS) Division

E-5 Instructor Policy Letter. The Engineer School has published an E-5 Instructor Policy Letter to alleviate the current instructor shortage adversely impacting engineer TASS battalions. TASS training battalions desiring to use E-5 instructors must comply with all aspects of the policy letter before the Engineer School will grant authorization to use E-5 personnel.

POC is MSG Robert Chartier, (573) 596-0131 ext. 3-5950, or e-mail *chartier@wood.army.mil.*

Department of Instruction

Graduate School. We continue to increase the number of graduate-degree options for our advanced-course students. We now have a degree in geology and geophysics to complement our preexisting degrees of engineering management, environmental engineering, civil engineering, and public policy and administration. Lieutenants should contact branch immediately for Engineer Officer Advanced Course scheduling.

POC is CPT Marc Hoffmeister, (573) 596-0131 ext. 3-5641, or DSN –5641, or e-mail *hoffmeim@wood.army.mil.*

Small-Group Leaders (SGLs) for Engineer Officer Advanced Course. An SGL serves as the instructor, leader, and mentor for his team of 14 students. The assignment is challenging and rewarding as each SGL contributes to the future shape of the Engineer Regiment. Branch-qualified captains are encouraged to consider an assignment as an SGL as a valuable component of their career progression and experience base. Commanders are encouraged to identify suitable officers and highlight the SGL assignment during career counseling.

POC is MAJ Dave Luhrs, -4128, or e-mail *luhrsd@wood.army.mil.*

Tactics Division

Planning Aid for Combat Engineers (PACE). PACE provides engineer planners at the battalion and brigade task-force levels with doctrinally based standardized engineer planning tools, information, and battle-tracking spreadsheets in digital and analog format. It includes sections on key duties of engineer staff, the military decision-making process/engineer estimate, engineer battlefield assessment, battle-tracking charts, and planning considerations for offensive and defensive operations. It can be downloaded from the Fort Leonard Wood Web pages at *http://www.wood.army.mil/Tact/.*

POC is MAJ Ken McKay, (573) 596-0131 ext. 3-5592, or DSN -5592, or e-mail *mckayk@wood.army.mil.*

Countermine Training Support Center

Countermine/Mine Awareness Training Aids. The Countermine Training Support Center does not have a supply of training aids, and the Humanitarian Demining Training Center (HDTC) is restricted from releasing training aids to units other than those legitimately supporting the U.S. Humanitarian Demining Program. In light of this situation, we offer the following assistance:

- Redstone Arsenal is the Army's production facility for many training aids (mine and UXO boards and "rubber ducks"). POCs at Redstone are Randy Porter, (256) 955-6079; Merlin Largen, (256) 842-2351; or Kenneth Patrick, (256) 876-0036.

- Your installation TSC should carry GTA 5-10-44, *The Mine-Awareness (SANDI) Card,* and the U.S. Mine Awareness Training Video (number 710956).

- The United Kingdom has produced an excellent mine-awareness video titled *Mine Strike.* You can obtain a copy through the British Defense Film Library, phone 011 44 1494 87825, or e-mail *bdfl@ssvc.com.*

- You can also attempt to procure actual inert mines (high quality but expensive) through Miltra Engineering Limited. The POC is Donald Syme, phone 011 44 1268 526 756. Redstone Arsenal and numerous other companies also produce expensive, inert mines.

Mobile Training Teams (MTTs). We continue to support requests for mine-awareness and countermine MTTs. Our calendar is filling fast, so if you're preparing for deployment and are in need of an MTT, please call soon. We normally try to schedule the actual training within three months of deployment.

POC is MAJ Randy Glaeser, (573) 596-0131 ext. 3-6199, or DSN -6199, or e-mail *glaeserr@wood.army.mil.*

Directorate of Training Development

Field Manual Update. The following field manuals have recently been printed and distributed. They are also available for viewing and downloading from the Reimer Training and Doctrine Digital Library at *http://155.217.58.58/atdls.htm.*

- FM 5-436, *Paving and Surfacing Operations*, dated 28 April 2000.
- FM 5-434, *Earthmoving Operations,* dated 15 June 2000.

The following field manuals will be sent to print within the next 60 days. Look for them on the MANSCEN Publications Page at *http://www.wood.army.mil/PUBS/newpubs.htm.*

- FM 90-13-1, *Combined-Arms Breaching Operations.* This manual provides combined-arms commanders, from company to brigade, and their staffs with the doctrine, tactics, and techniques needed to successfully overcome obstacles. It provides the commander with breaching fundamentals and information for planning, preparing, and executing breaching operations.

- FM 5-105, *Topographic Operations.* This manual describes doctrine for topographic operations in support of the U.S. Army's strategic, operational, and tactical mission.

POC is Sandra Gibson, -4100, or e-mail *gibsons@wood.army.mil.*

Lead the Way

Command Sergeant Major Arthur Laughlin
U.S. Army Engineer School

An Azimuth Check

Engineers everywhere are fully engaged in their heavy summer training schedules. Here at Fort Leonard Wood, the drill sergeants and cadre are busy with the annual surge of trainees who migrate with the civilian school cycles. And in our many reserve and guard training areas, engineer units are conducting their annual training that provides their best opportunity of the year to gain collective competence in their mission-essential tasks. At active duty posts, the normal hustle of training deployments and support is increased with reserve augmentees, cadets in apprentice troop-leading roles, supporting reserve unit training, and the surge of personnel turnover.

It is during these busy times when we lose sight of the bigger picture—what we are and what we are all about and how are we doing. Fortunately, our Regiment addressed all that in our recent ENFORCE Conference. It is important that all of us understand the big picture and how it could change. We NCOs must understand it and pass it on to the troops. We have known since George Washington was in charge that American soldiers are more effective, more committed, and more dogged in action if they know the big picture and what they are fighting for. We, as NCOs, are the glue that holds together the senior leadership and the soldiers. So here is a quick, big picture from ENFORCE. Tell your troops about it.

General Shinseki, Chief of Staff of the Army, explained that the Army is "bifurcated." That is, it has the best ever heavy forces in the world's history and light forces that are unmatched. That combination can be effective when used in a deliberate theater of war. But, the combination, when deployed, is either lean OR mean in a hasty theater—which isn't effective. So, General Shinseki has asked the Army to find a way to become lean AND mean by making a majority of its forces medium weight. There would no longer be a heavy force or a light force—just one basic type that combined the best of both forces. This is the Army's Vision.

General Abrams, TRADOC Commanding General, told us that the Army isn't going anywhere without its engineers—that we have always been and always will be an integral piece of Army missions.

Lieutenant General Ballard, Chief of Engineers, expressed his great affection for the Corps and its soldiers. He told us that the branch would come out of this transition better, stronger, and smarter and remain fully engaged throughout. Thus, we cannot lose our perspective. In the end, the result will be a stronger Regiment.

We must pass these words of wisdom out to our soldiers. They, too, must see the big picture.

Essayons!!

CSM's Note:

I want to publicly thank and say farewell to the following command sergeants major who will leave the Army this year after having served with all their being, mind, heart, and body. Our Regiment will be forever in their debt. Their presence in their units will certainly be missed. We wish them Godspeed and the best of everything.

- CSM Harold Montgomery, Division CSM, 1st Infantry Division, Wurzburg, Germany
- CSM Thomas Bruce, 44th Engineer Battalion, Camp Howze, Korea
- CSM John Cooper, Garrison CSM, Fort Leonard Wood, Missouri
- CSM Michael Garman, 14th Engineer Battalion, Fort Lewis, Washington
- CSM Jesus Gomez, Commandant, NCO Academy, Fort Leonard Wood, Missouri
- CSM Raymond Greigo, 52d Engineer Battalion, Fort Carson, Colorado
- CSM John Hemrick, 20th Engineer Brigade, Fort Bragg, North Carolina
- CSM Michael Leiber, 5th Engineer Battalion, Fort Leonard Wood, Missouri
- CSM Anthony Orlando, 299th Engineer Battalion, Fort Hood, Texas
- CSM Norman Rowland, 8th Engineer Battalion, Fort Hood Texas
- CSM Lonnie Clark, 588th Engineer Battalion, Fort Hood, Texas
- CSM Frank Hall, 937th Engineer Group, Fort Riley, Kansas
- CSM Robert Seiler, Engineer Brigade, 4th Infantry Division, Fort Hood, Texas
- CSM Alvin Shimizu, 29th Topographic Battalion, Fort Shafter, Hawaii

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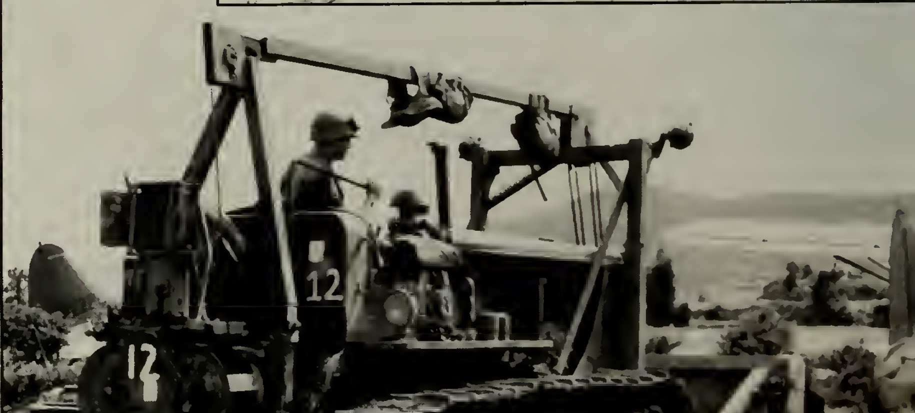

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CLEAR THE WAY

By Major General Robert B. Flowers
Commandant, U.S. Army Engineer School

As I look back at the past 39 months, I realize that if I had had a choice of when to be Commandant of the Engineer School, this was the best time. But now it's time to say good-bye.

I've spent a good portion of my time as Commandant visiting engineer units all over the world. I've seen firsthand officers, NCOs, and soldiers at work and their pride in accomplishing the diverse missions of the Engineer Regiment. I am immensely proud of the enthusiasm and professionalism displayed by all of them. Sappers, both active duty and Reserve Component, are decisively engaged in every major deployment that the Army is involved in. The Engineer Regiment continues to lean more heavily on the Reserve Component with the increased number of deployments we are required to support.

The engineer future is bright, as we have major changes underway in materiel developments. We've led the Army's effort in the antipersonnel land mine alternatives program, which includes development of the new RADAM artillery-delivered antitank mine system and an alternative to our non-self-destructing antipersonnel mines.

We led the Maneuver Support Center efforts for keeping soldiers out of hazardous situations by giving them robotic equipment. The soldiers in Bosnia and Kosovo have been provided robotic countermine equipment and training, like the M60 Panther and the Miniflail. October should see the M1 Abrams Panther being issued to the contingency forces in the Balkans. The soldiers fighting in urban/tunnel environments have been introduced to small robots used in the JCF AWE at Fort Polk, Louisiana.

In October, we will field the Basic Hornet to the 82d Airborne Division. The Hornet changes the way we attack enemy schemes of maneuver and influences the commanders who work with mines at a higher echelon than we've ever addressed. In December, we will begin fielding the Wolverine to the 4th Mechanized Infantry Division, and in March, they will take those Wolverines to the division's Capstone Exercise. We have 26 Wolverines in the pipeline with a dozen more going on order next year.

We fielded an interim vehicle-mounted mine detector last year as part of planned countermine capability sets. We're developing ground-penetrating radar for those ten systems to detect nonmetallic mines. We'll add them in FY02 as part of the Ground Standoff Minefield-Detection System (GSTAMIDS) Program. In the meantime, we begin final development of the handheld STAMIDS (HSTAMIDS) next year. If test results continue to be encouraging, we may buy some early for contingencies.

Next year, we start two more major programs, the Raptor Intelligent Combat Outpost and the Mongoose Explosive Standoff Mine Clearer. Both are critical enablers for the Interim Brigade Combat Team. The Raptor will be pivotal to our ability to dominate terrain over the distances we have to cover with the interim and objective forces. And, we've made the Mongoose C-130 deployable and mobile enough to be the interim force's minefield clearer.

The Grizzly continues to be the centerpiece of our countermine capability and is recognized by TRADOC and DA as essential to the success of the heavy counterattack force. The two prototypes are performing splendidly. Keep reminding your maneuver bosses and brethren that we've got to automate and armor the complex obstacle-breaching task. It's the only way we can accomplish the mission without enormous penalties in casualties, tempo, and training time.

As the Army defines the substance of information dominance, the future of our Regiment is indelibly linked to digital terrain data. From the strategic level, the TRADOC Program Integration Office-Terrain Data (TPIO-TD) completed a two-year effort to define terrain-data requirements for the Army. The TPIO-TD now leads a robust Army team that is working with the National Imagery and Mapping Agency to develop an implementation strategy across the DoD. From a tactical and operational level, the Terrain-Visualization Center and the MANSCEN Directorate of Combat Developments lead the proponent effort to provide the tools to the field to ensure that the engineer is clearly established as the terrain-data expert in the digital force. Over the past three years, we have been able to get the terrain expertise and equipment in the digital division down to the maneuver-brigade level. We have also developed the ability to take this geospatial information and rapidly put it in the hands of the frontline soldiers with the prototype development of the high-volume digital printers. We are driving a fast train that is revolutionizing the way the Army sees the terrain. Every engineer must be a part of this exciting chapter in engineering.

With all that the Engineer Regiment is involved in, we must continue to focus and give priority to modernization. I encourage all of you to remain situationally aware by staying connected to your school and your Regiment. In these resource-constrained times, it is essential that the entire Regiment continues to speak with one voice. I am confident that our great engineer soldiers all want to be successful and will continue to do the right thing. All we as leaders must do is work to get them the resources they need and then point them in the right direction.

I know that our Regiment is in excellent hands as Major General Anders B. Aadland assumes his role as Commandant.

It has been an awesome 39 months. I am truly grateful for the support of everyone in the Fort Leonard Wood community and the entire Engineer Regiment. I am proud and honored to be part of the engineer heritage. Whether fighting fires on the home front, building roads for the people of Kosrae, or keeping the peace in Kosovo, engineers are always "on point."

Essayons!

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Front Cover: *The skid steer is shown with one of its seven attachments, the picket pounder. (Photo by PFC Matthew J. Jenkins.)*

Back Cover: *Engineers of the 8th New York State Militia during the Civil War.*

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Engineers, Where Do We Go From Here?

By Lieutenant Colonel Kevin S. Lindsay

This article is intended to stimulate thought and discussion on possible future directions for engineers. Although the article does not necessarily express an official Engineer School position or proposal, the author proposes some actions that might allow us to meet Chief of Staff of the Army General Eric K. Shinseki's vision. The author also illustrates possible future engineer organizations that would be more in line with that vision.

Although engineers remain respected and valuable members of the Army team, it seems we are continually losing key force structure and modernization battles. The armored combat earthmover (ACE) took so long to get fielded that even when it was new, it was already a generation behind other members of the mechanized team. We may still win the fight over the heavy engineer-brigade headquarters, the Wolverine (see article, page 21), and the Grizzly, but the fact that their future is uncertain tells us that many key people in the Army see higher priorities out there for people and dollars.

While we have been struggling to deal with long-standing equipment and organizational problems, Army downsizing has added a new set of problems. We've had to make tough decisions on which units to eliminate or move to the Reserve Component (RC), and we've suffered from the same "salami slicing" (taking a little away from all units to avoid cutting more units) as the rest of the Army. So we've reduced many engineer squads from ten to eight soldiers and steadily reduced support personnel. Units often respond to the latter by detailing soldiers from line platoons into support positions. Many units, even when they are at 100 percent strength, are not as capable as they were twenty years ago.

Review Roles and Missions

So what do we do? How can we not only maintain our current capabilities but actually increase our abilities to support the Army in an era of changing missions, shrinking budgets, and reduced personnel levels? We know that we can't simply dig our heels in to hold on to those systems and structures we've fought for based on the "Cold War Army." While we might win in the short term, in the long term, any system or structure that doesn't support post-Cold War realities will become a bill payer for those that do. It's just a matter of time. *What we must do is identify where the Army is going and what it needs its engineers to do.* We need a total review of our roles and missions and a top-to-bottom review of our units and our command-and-control (C2) structure.

The Army Vision

Realizing that we're not likely to get more money and more people, we have to ensure that we're focused on doing those things that the Army needs most from its engineers. General Shinseki's vision for the Army includes the following:

- **Strategic dominance**. Dominance at every point of the spectrum—from humanitarian assistance and disaster relief, to peacekeeping, to major theaters of war.
- **Responsive**. Quick deployment, over long distances, with sustained momentum.
- **Deployable**. Combat forces capable of going anywhere in the world—a brigade combat team (BCT) in 96 hours after liftoff and a division in 120 hours.
- **Agile**. Forces capable of transitioning quickly from stability support, to warfighting, and back.

- **Versatile**. Units able to fight at any point on the spectrum of operations with minimal adjustment.
- **Lethal**. Every element in the warfighting formation capable of generating combat power and contributing decisively to the fight.
- **Survivable**. Maximum protection at the individual-soldier level.
- **Sustainable**. Reduced logistics footprint and replenishment demand.

The Army's move to create "medium" maneuver forces and the discussions on making heavy forces more deployable and lighter forces more lethal are due to the recognition that we will likely have to move to the fight. Hopefully, if we can move fast enough, we can win the war before it starts by stabilizing a region or reinforcing a weaker ally to the point that an aggressor decides not to attack. If war does break out, then we want to deploy overwhelming combat power quickly to defeat an enemy with minimal loss of friendly forces. Once active combat ends, we must be able to transition to peacekeeping and stability operations. Key engineer considerations for these operations will include the following:

- Construction projects will support civil and military infrastructure to help deter aggression and strengthen a friendly government. Engineers are unique in their ability to provide highly visible assistance to a friendly nation and show U.S. support in a nonagressive manner. Active and reserve construction units have been successfully doing this for years. Airborne and light corps battalions (which are really medium battalions with a great deal of engineer equipment) give us the capability to deploy for these types of missions quickly by air.
- Engineers deployed for nation assistance may also assist in the buildup of U.S. combat power and play a key role in subsequent combat operations. *Versatility is a must.*
- Dynamic obstacles—such as the Volcano, Hornet/Raptor, and Modular-Pack Mine System (MOPMS)—and future scatterable mines will be key if enemy forces engage light and medium forces that arrive early. Dispersion of forces will hinder the emplacement of labor- and time-intensive conventional obstacles.
- Survivability support to light and medium forces could be key because they will not have the heavy armor of the Abrams tank and the Bradley fighting vehicle.
- Support to aerial ports and seaports of debarkation and road networks will be key to the rapid buildup of forces. As potential enemies learn to deliver chemical agents, mines, and conventional munitions deeper and more accurately, our ability to use established airfields and ports will be threatened. We must have the ability for airborne insertion and landing at small, austere airfields. We also must be able to bring in logistics over the shore.
- In-stride breaching (breaching obstacles without dismounting and stopping the maneuver force's momentum) will be key for forces on the attack.
- Air-assault operations will play a greater role as medium formations are created that can be rapidly moved by the joint tactical rotorcraft (JTR) and its planned 20-ton lift capability. These operations will allow engineers to provide rapid mobility support without having to move as part of the maneuver formation. This should be especially true for bridging and small earth-moving operations, where we've actually lost air-assault capability since Vietnam.
- Maneuver forces will still want well-maintained supply routes from the aerial ports or seaports of debarkation to the battalion trains. While future forces will make maximum use of the JTR, commanders will not want to be limited to aerial resupply. A force with such a limitation would be open to catastrophe if the JTR was grounded due to a new enemy air-defense system or some unforeseen weather condition.
- Enemy forces will rely more on their own dynamic obstacles and will gain improved capability to deliver scatterable mines and other munitions on our supply lines. Similarly, they will gain in their abilities to destroy point targets, such as bridges, along our supply lines.
- Dispersion of forces will lead enemy defenders to rely less on labor- and equipment-intensive obstacles such as tank ditches and conventional mines once combat is initiated. Instead, they will reinforce natural obstacles and make maximum use of rapidly delivered scatterable mines.
- We still will encounter heavy use of conventional mines and obstacles in peace enforcement and small-scale contingencies where factions have had months and years to place obstacles.

Recommended Changes

To better meet these future engineer requirements and to address the challenges brought on by aging equipment and the Army's downsizing, we should consider the following when developing our modernization plan:

1. Minimize our organic/normally associated footprint in maneuver formations (battalion task forces).

2. Focus on our unique capabilities to meet future maneuver-force requirements.

3. Simplify engineer C2.

4. Examine and redefine the role of the combat-engineer squad in support of mounted formations.

5. Ensure that we have robust (strong, healthy) engineer units at the execution level.

6. Integrate Active Component (AC) and RC engineers.

7. Improve equipment by going after high-payoff, low-cost developments and modifications.

The following paragraphs elaborate on each of these seven areas. The intent is to stimulate thought—not to criticize past efforts or to imply that these are the only ways to move forward. As anyone who has ever worked a decision-making process or other problem-solving technique knows, the best solution is usually one that emerges during the analysis of several distinctly different courses of action.

1. Minimize our organic/normally associated footprint in maneuver formations (battalion task forces).

As we look to the future, our first challenge is to define the engineer-support requirements for maneuver formations whose capabilities are still being developed. Many assumptions are being made about the mobility, countermobility, survivability, general-engineering, and topographic-support requirements of future forces. Most of these assumptions are toward minimizing engineer-support requirements through revolutionary weapons or logistics technologies.

The Army's goal is to minimize the need for specialized units such as engineer, air-defense, and fire-support teams that must move with the maneuver formation. The logic in this is simple and not really new: All of these specialized forces must be carefully maneuvered to be at the right place at the right time. Not only does this complicate the maneuver commander's job, but these forces also must be deployed in large numbers to ensure that they are there when needed. As a result, the normally associated mechanized engineer battalions that support each heavy maneuver brigade significantly increase the lift necessary to move the brigade. However, they often find themselves underemployed while moving with the brigade (for example, after the initial obstacles were breached in Desert Storm). And, they lack the versatility to support reception, staging, onward movement, and integration (RSOI), bases, and combat-support and combat-service-support (CS/CSS) operations. As a result, we often find ourselves with excess "assault engineers" and are forced to take up more critical lift to move echelon-above-division (EAD) engineers to support RSOI, bases, and CS/CSS operations.

In reality, the Army has already adopted this recommendation and currently plans to put only a small company in the medium interim brigade combat team (IBCT). While the exact size of the company may change, it seems unlikely that future divisions will have an engineer battalion to support each ground maneuver brigade. This may seem like a bad decision to some, but it probably is a reasonable one. If we can keep our normally associated footprint small, but capable, we can build more versatility into the division as a whole by creating a second divisional combat battalion that is not normally associated. This battalion could have the versatility to support a broad range of combat, RSOI, base support, and CS/CSS operations. As the remaining recommendations will point out, we can follow the Army's lead on this and create more versatile, agile, and deployable engineer organizations with companies instead of battalions as the normally associated engineer force supporting a maneuver brigade.

2. Focus on our unique capabilities to meet future maneuver-force requirements.

Currently, combat engineers spend a great deal of time performing labor-intensive tasks that others could do. Concertina obstacles and fences are general battlefield tasks that all soldiers should be able to do—just like digging a fighting position. If we spend great quantities of man-hours (which we are) erecting wire obstacles and fences (including fratricide fencing), then we are providing unskilled labor. Others could perform this labor, but they don't—because they have more important jobs to do. This puts us at a severe disadvantage in the prioritization fight. We also should avoid pursuing force structure for scouting and forward reconnaissance missions for maneuver forces. Instead, we should be able to attach experts to the scouts for engineer-specific reconnaissance. We should also continue pushing rapid topographic support and terrain analysis to units. These are unique engineer capabilities.

Other future requirements that we are uniquely capable of supporting include the following:

Maintenance and repair of main supply routes (MSRs). This mission will be even more important on a widely dispersed battlefield against future enemies that can attack our MSRs with long-range precision munitions and scatterable mines. While the future JTR promises reduced reliance on ground MSRs, few commanders will want to be totally reliant on air resupply for very long. Even in Vietnam (a classic light-infantry/air-assault war), MSR maintenance and repair were major engineer missions. Unfortunately, there is general confusion over whether MSR maintenance (to include bridging) is a mobility or general-engineering/sustainment task. Field Manual (FM) 5-101, *Mobility*, clearly focuses on mobility support to ground maneuver forces—infantry and armor. Bridging and road maintenance and repair, which could be key to a maneuver task force's mobility, are currently considered general-engineering tasks and are covered in FM 5-104, *General Engineering*. When senior leaders talk about mobility, they are often including mobility of unit supplies along the MSR. We have not done a good job of articulating the importance to the Army of maintaining supply routes in the task-force, brigade, and division areas. Articulating the importance of this mission, and fighting for equipment to perform it, will be key to getting the right engineer force to support it in the future. We should start by moving MSR maintenance and repair and bridging out of the "general-engineering" category and include them in "mobility."

Support outside of the maneuver brigades—brigade support areas (BSAs) and aviation, corps artillery, air-defense, and CSS units. As part of the Engineer Restructure Initiative, we put a battalion for each maneuver brigade in the heavy division. These battalions have little sustainment-engineering capability. They lack the versatility to support stability operations (which typically require general engineering) or to support force-buildup operations. This means that corps engineers must deploy early to support stability operations and force buildup. This lack of versatility in heavy-division engineers also means that there are no divisional engineers to support anyone outside the maneuver brigades. (In reality, there are very few engineers to support anyone outside the maneuver task force.) We currently rely on corps engineers to support BSAs, MSR maintenance and repair, aviation assembly areas, towed-artillery survivability, air-defense artillery, CSS units in the division support area, and bridging beyond the armored vehicle-launched bridge (AVLB). The units in question don't need just mechanized engineers—they also need equipment for survivability berms and trenches, leveling ground for support areas, dust control, and simple construction support for bunkers and basic quality-of-life projects. Future structures should correct this lack of versatility in the division's organic engineers. This would enable the division to execute a broader range of missions without corps engineer augmentation—making the division more responsive and deployable.

Minefield clearing and unexploded-ordnance (UXO) disposal. We have said loud and clear that demining and UXO removal are not our missions. We focus almost exclusively on assault breaching of minefields. We may have said this out of fear of becoming bogged down and exposing our troops to unnecessary danger. However, this is very shortsighted on our part. Minefield clearing and obstacle reduction (removal as opposed to breaching or bypassing) are engineer mobility tasks per FM 5-101. Artillery, air- and ground-delivered scatterable mines, and cluster bombs lead to a very dirty battlefield. Enemies increasingly will be able to place scatterable mines on MSRs, airfields, bases, and previously breached minefields. Even if they cannot place direct or indirect fires on these, they will pose a major obstacle on our supply lines if we cannot clear them quickly. Explosive-ordnance-disposal personnel cannot perform these missions alone. We should have the equipment and tactics, techniques, and procedures (TTP) to detonate large numbers of surface-laid or shallow mines/UXO. By taking advantage of our demolition skills and the systems already developed, we could greatly enhance our divisional and corps engineers' ability to safely detect and clear UXO along MSRs, within potential bases, and from assault and helicopter landing zones.

3. Simplify engineer C2.

We should simplify our C2 structure and align it better with supported maneuver units.

Discontinue either brigades or groups. Eliminate one level of C2 and produce a flatter organization that can take advantage of digital information systems. Each division (heavy, medium, and light) should have one brigade/group, and each corps should have one. There should also be some number of brigades/groups for the theater rear. These headquarters could be multicomponent with a mix of AC and RC subordinate units. This would allow a smooth transition from peacetime training, to deployment, to combat/peacekeeping, to redeployment. Each of these brigade/groups (including divisions) should have some type of construction-management section (most would be predominately RC) that would perform drills and annual training with the unit and go to war with them. The RC groups and brigades (15 groups and 4 brigades currently in the structure) could be combined with AC groups and brigades to provide each division and corps with a group. Construction-management sections could be fairly small, utilizing the U.S. Army Corps of Engineers to support any heavy design or highly technical requirements.

Use the same basic engineer C2 structure for heavy, medium, and light forces. Currently, we have heavy divisions with O-6 engineers (we may convert this to an O-6 staff engineer without a brigade headquarters), O-5 brigade engineers, and O-3 task-force engineers. Light, airborne, and air-assault divisions have O-5 engineers, O-3 brigade engineers, and light task-force engineers (one level lower than heavy divisions). The new medium brigade is expected to have an O-5/O-4 engineer with just one organic company. Currently, due to lack of sustainment engineers, all divisions would likely receive large corps augmentation (three to five battalion equivalents) depending on their priority. We try to assign a group to all types of divisions that receive significant corps augmentation.

To provide consistent engineer C2 and a smooth transition during contingencies, we should apply the following recommendations to all maneuver divisions and brigades:

- Assign an O-6 group engineer as the division engineer for all divisions.
- Provide a robust group staff to support division tactical (DTAC), division main (DMAIN), and division rear (DREAR) command posts with a minimum of a major, a captain, and two NCOs for each command post (DMAIN would be larger, of course) without pulling the group XO, S1, or S4. The DREAR should also have a construction-management section.
- Provide an O-4 staff engineer (supported by a captain or first lieutenant, and two NCOs) for each maneuver brigade and the aviation brigade.
- Provide liaison teams (staff sergeant and specialist) for engineer platoons to assist the task-force engineer platoon leader. If trained properly, these teams could assist platoon leaders during planning and then track scatterable mines, other obstacles, and mission status during execution. This would allow platoon leaders to focus on leading their platoons in combat.

Reduce the types of corps battalions. Corps battalions must be versatile—capable of both combat and construction missions. The current combat-heavy battalion with its six vertical-construction platoons is difficult to employ efficiently once combat starts (except in and around rear-area bases). The Army is attempting to reduce our deployed footprint by maximizing use of host-nation and contract engineers. This plan directly threatens the need for our current number of combat-heavy battalions (42 active and reserve). Similarly, corps mechanized battalions (14 active and reserve) have almost no capability to maintain and repair MSRs or to support rear-area bases.

A more efficient system would be to convert current combat-heavy, corps wheeled, and mechanized battalions to multifunctional combat/construction battalions. Separate horizontal, vertical, and bridge companies would then be attached to these multifunctional battalions based on the mission, enemy, terrain, troops, and time available (METT-T). Each battalion—consisting of three line companies with one horizontal platoon and two combat platoons each and a vertical platoon and construction management section in the headquarters and headquarters company (HHC)—could work anywhere from the brigade area to the theater rear. This would reduce the amount of task-organization changes to a bare minimum.

Note: The separate companies mentioned above must be able to break out platoons similar to the way prime-power platoons can be deployed from the company. In peacetime, these separate numbered companies would be assigned to a multfunctional battalion as a fourth company. (This is commonly done with current combat-support-equipment [CSE] and light-equipment companies.)

4. Examine and redefine the role of the combat-engineer squad in support of mounted formations.

Mounted maneuver commanders have been saying for years that they want their engineers to do two things: conduct in-stride breaches and create dynamic obstacles. This simple request poses several issues for engineers to consider:

- The need for organic or normally associated combat-engineer squads to meet these two needs will continue to diminish. Mounted maneuver units need breaching and mine-laying equipment with well-trained operators—not a squad that dismounts to breach or place obstacles by hand.
- We must continue to develop equipment and TTP that enable mounted engineers to perform required mobility tasks using the vehicles they operate (and that protect them).
- We are maintaining unnecessarily large engineer assault elements because of our desire to keep military occupational specialty (MOS) 12B (combat engineer) squads for mobility/countermobility support in mounted units.

Therefore, for mounted forces, we need to look at our assault engineers primarily as vehicles/equipment fighting as part of a mounted formation—not as transporters of dismounted engineers. Doctrine for medium forces is still being developed, but so far it seems that the medium brigade will be infantry-heavy and move in an armored personnel carrier. Again, it seems that equipment to allow rapid movement by these personnel carriers would be more important than the ability to dismount large numbers of engineers. Dismounted infantry can perform many of the same tasks that dismounted engineers would perform. What the infantry probably can't do is conduct in-stride breaches, create dynamic obstacles, and clear rubble/demolish buildings in military operations in urban terrain without engineer-equipment support. The objective force of 2020 to 2030 will rely on specialty units (such as engineer, fire-support, and air-defense) as little as possible. Rather, the capabilities that these elements currently bring to the task force will be built into the maneuver force's vehicles, equipment, and personnel to the maximum extent possible. This further underscores the need to focus on doing those things that only an engineer can reasonably do.

Future engineers who are organic or normally associated with a maneuver force should therefore be very equipment- focused. This equipment must have two operators per vehicle for 24-hour operations. (Why take critical air- or sea-lift space for a piece of equipment if we cannot operate and maintain it 24 hours a day?) The intent here is not to diminish the importance of combat-engineer squads; they remain critical because of their versatility. They allow the combat platoons to be versatile by conducting operations such as route-clearance, obstacle-reduction, and area-clearance after a breach; constructing culverts, bunkers, bridging, and lodgments; providing rear-area security; and fighting as infantry, when necessary. It does seem that 12Bs have lost some of their versatility over the past twenty years. We've significantly reduced the sets, kits, and outfits (SKO) that they carry. Perhaps this is due in part to the reduction to eight-man squads. This trend must be reversed because it clearly goes against General Shinseki's vision of more versatile units.

5. Ensure that we have robust engineer units at the execution level.

We should ensure that units are robust enough to complete missions even when they are short up to 20 percent of their personnel due to peacetime shortages (leaves, transitions, schools, special duties, support details) or combat losses.

Return to ten-man squads. In going to eight-man squads, we have assumed away too many real problems and reduced the squad's versatility (counter to General Shinseki's vision). When the squad dismounts, it must leave a driver (a "shotgun" is also required in many cases) with the vehicle. In peacetime, profiles, personnel transitions, leaves, schools, special duties, and support details (internal and external) mean that an eight-man squad will be short even if the unit is manned to 100 percent on paper. Also, with only five junior enlisted soldiers (including the vehicle driver), the squad has little opportunity to cross train soldiers on construction and the use of special equipment or tools. These same problems will continue in combat; plus, we may have battle casualties.

Man platoon, company, and higher headquarters with sufficient drivers and support personnel to avoid detailing them from squads. Another drain on our squads is that we have allowed modified tables of organization and equipment (MTOEs) to be made that do not provide sufficient drivers, mechanics, and support personnel. Every vehicle must have a dedicated driver; engineer equipment should have two drivers for a 24-hour operation. We need to look at each unit and put the positions on the MTOE to prevent squads and sections from being raided for drivers and mechanics. The same is true for other critical support personnel such as supply; communications; nuclear, biological, and chemical; and armorers.

6. Integrate AC and RC engineers.

We should truly integrate AC and RC units, taking advantage of each other's strengths, especially in headquarters, construction management, and sustainment engineering. The robust structure that we need to command and control organic and reinforcing corps engineers and maintain lines of communication can only be reached if we integrate RC engineers into active divisions.

Construction-management is a prime example of a function that could be performed as well or better by RC personnel. A small active-duty section would be augmented by RC soldiers on weekend drills, during annual training, and when deployed for combat. These RC soldiers often bring technical skills beyond what we can reasonably expect in the AC. Also, some of the units in the division could be RC. To be integrated, the AC will need to make some adjustments. For example, a multicomponent unit will have to designate one weekend a month for training, with two designated comp days shortly thereafter. This may sound silly, but it's a major issue when an RC unit wants to train with an AC unit. Often, the AC unit looks at the training as yet another weekend in the field and says no unless it was already planning to be in the field. AC units tend to expect RC units to adjust their schedule to meet the AC schedule. However, this isn't practical because RC units try to lock in their 39 training days a year out, versus six weeks in AC units. Multicomponent training should be routine and predictable; for example, AC units could plan that "the third weekend of every month, we will train with our RC units."

7. Improve equipment by going after high-payoff, low-cost developments and modifications.

The recent cuts in the Grizzly and Wolverine programs illustrate how difficult it is to get major systems fielded—even when they are fully justified. Maybe we can go for lower-cost systems that take advantage of commercial technology, make current systems (such as the Palletized Load System [PLS]) work for medium and light forces, and look at improvements to current systems.

Air-assault and air-transport capabilities. Air assaulting engineer equipment to where it is needed is a critical engineer force multiplier that was used very well in Vietnam in support of both light and mechanized forces. The JTR will be able to transport 20 tons. We should now start planning to procure equipment that will take advantage of this capability. For example, there are D6 dozers that weigh less than 20 tons. With D6s that compare favorably with current D7 capabilities, does it make sense to rebuild/replace the D7 fleet–or should we begin transitioning to a D6? The later would seem the obvious choice. Similar decisions can be made for most of our engineer equipment. The capabilities of the C-17 and JTR should allow our medium forces to possess capabilities that rival our current heavy engineers, thus enabling our heavy and light organizations to be merged into medium units in keeping with General Shinseki's vision for the objective force.

Future Combat System-Engineer (FCS-EN). Divisional and EAD combat engineers should move in the FCS for force protection. We should be working with the Army to ensure that the FCS has as much mobility capability as possible. The following options should be pursued for the FCS-EN (priority as listed):

- A small bulldozer blade. This blade could be used to dig in, breach, clear rubble, and receive attachments such as a mine roller or plow that rests on the ground to reduce stress on the blade arms.
- A demolition round fired by all FCSs or an FCS-EN.
- A simple heavy-duty grapnel hook that could be fired from the FCS and then mechanically retrieved to cut barbed wire and detonate trip wires.
- Hydraulic and electric tool connections similar to the capability of the current hydraulic-electric tool outfit (HETO) trailer.

These items should be included in all FCSs, as much as possible. If they cannot be, then an FCS-EN should be developed. The capabilities of FCSs versus an FCS-EN or other future combat-engineer vehicle will largely determine the requirements for engineers in the maneuver-task-force formation.

Integrated trailers. We need to take a hard look at our trailers. By upgrading them for use with standard Army prime movers, such as the interim fighting vehicle (IFV)/FCS and family of medium tactical vehicles (FMTVs), we can increase our capabilities at an economical cost. Items such as the new hydraulic tool trailer are a step in the right direction, but we can do more.

Mechanized engineers lost the earth-moving capability and versatility provided by a dump truck in order to improve their survivability. Current thinking is that there may be no engineer variant of the IFV and possibly none for the FCS. It would therefore be a tremendous asset to have a highly mobile trailer that could dump 3 to 5 tons of material. Mine/countermine sets, demolitions, and SKO could be stored in an insert that is easily dumped and retrieved using some type of mini-PLS. Additional features of this trailer should include the ability to "daisy chain" trailers so that one prime mover can pull more than one trailer and a quick disconnect system that allows drivers to disconnect trailers without leaving the cab. These two features, combined with the ability of the medium PLS (described later) to transport two trailers at a time, would allow trailers to "catch up" with elements that have dropped trailers based on METT-T. When combined with the following two inserts, this system would give us tremendous versatility and agility to perform both combat and construction tasks:

- **A mine/countermine insert.** It should contain a Ground Standoff Minefield-Detection System (GSTAMIDS) and other future detection and detonation equipment for use in conjunction with the dump trailer. Optimally, the dump trailer could be attached to the blade on the FCS-EN for mine-clearing operations. In this mode, weight (dirt) would be added to the trailer to make it heavy enough to stay on the ground when a mine is detonated. *Note: Many scatterable antitank (AT) mines are relatively small shaped charges that would do little damage to a trailer filled with dirt.* The GSTAMIDS or other future system could be mounted and suspected mines detonated.

Filled with dirt and equipped with proofing wheels, the trailer would then proof the cleared area in advance of the FCS.

- **An integrated skid steer with tools and attachments insert.** (See article, page 22). With special boxes for hydraulic tools and attachments, the skid steer can load dump trailers, FMTV dumps, and PLS dumps. While the skid steer's bucket is small. the loading speed on many smaller jobs is not critical. The skid steer can go places that small emplacement excavators (SEEs) and bucket loaders cannot go, and it is also easily air assaultable. This integrated piece of equipment. tools, and trailer could be deployed and pulled by anything from an IFV/FCS to a 5-ton truck. With the skid steer, combat engineers could efficiently perform a variety of combat tasks (such as obstacle and bunker construction) and sustainment tasks (such as road repair and vertical construction).

Medium combat-engineer vehicle (MCEV). This item is based on an assumption that we will be able to develop a more capable and survivable combat breacher than the FCS-EN if we limit the crew to three. The smaller crew should enable a lower silhouette, more armor, and a more capable breaching blade. This vehicle should have a blade on the front similar to the Grizzly, a demolition gun, and the same heavy-duty grapnel as described above for the FCS-EN. Deleting the Grizzly's bucket arm should reduce the weight and cost.

Bridge sets. We need a variety of bridge sets that can be rapidly deployed and placed by non-bridge units. With the IFV/ FCS being Class 20 or less, we should be able to produce an air-assaultable bridge that could be placed directly over small gaps (reducing requirements for future medium AVLBs) to cross the IFV/FCS. In fact, this was done in Vietnam with M4T6 dry spans. We should also have air-assaultable piers for these bridges to allow multiple sections to be air assaulted in to span larger gaps. This bridge system could be placed by any engineer unit (site prep by an air-assaultable blade would often be required) and greatly reduce the requirement for specialty bridge companies. *Note: A version of this bridge could be developed for launching from a PLS module.*

Automated fence and marking system. It currently takes more man-hours to mark scatterable minefields than to emplace them. We should be able to come up with some type of rapid marking system that can be attached to a high-mobility, multipurpose wheeled vehicle (HMMWV), a SEE, or a truck to eliminate having 12Bs hand-emplace fences. This system should also allow for some type of antipersonnel obstacle similar in effect to triple-standard concertina wire.

PLS for light and medium forces. Current PLS dump (12 cubic yards), water-distributor, and concrete-mixer modules appear to be easily modified for air deployment because they can be broken down from their prime mover. We need a lighter version of the PLS that can haul 20-ton engineer equipment–such as D6s, loaders, graders, and deployable universal combat earthmovers (DEUCEs)– Class IV, and current and future PLS modules. An example is a 5- or 10-ton tractor that could pull a trailer capable of loading and off-loading PLS racks and able to haul equipment/Class IV when no rack is loaded.While this seems like a lot, it should be doable with rollers and a wrecker-like system attached to the tractor. *Note: The current PLS can haul two racks–one on the prime mover and one on the trailer. This system would only haul one on the trailer.*

The main difference between light and heavy horizontal engineers is their earth-moving capabilities. A 12-cubic-yard (14 cubic yards with sideboards) dump truck would be a tremendous improvement. Light units' graders, loaders, and dozers/DEUCEs are already ideal for most MSR maintenance missions. Using PLS technology would also reduce development costs because heavy, medium, and light units could use many of the same systems. As later structure discussion will show, a medium PLS will provide tremendous capability, versatility, and agility to future forces.

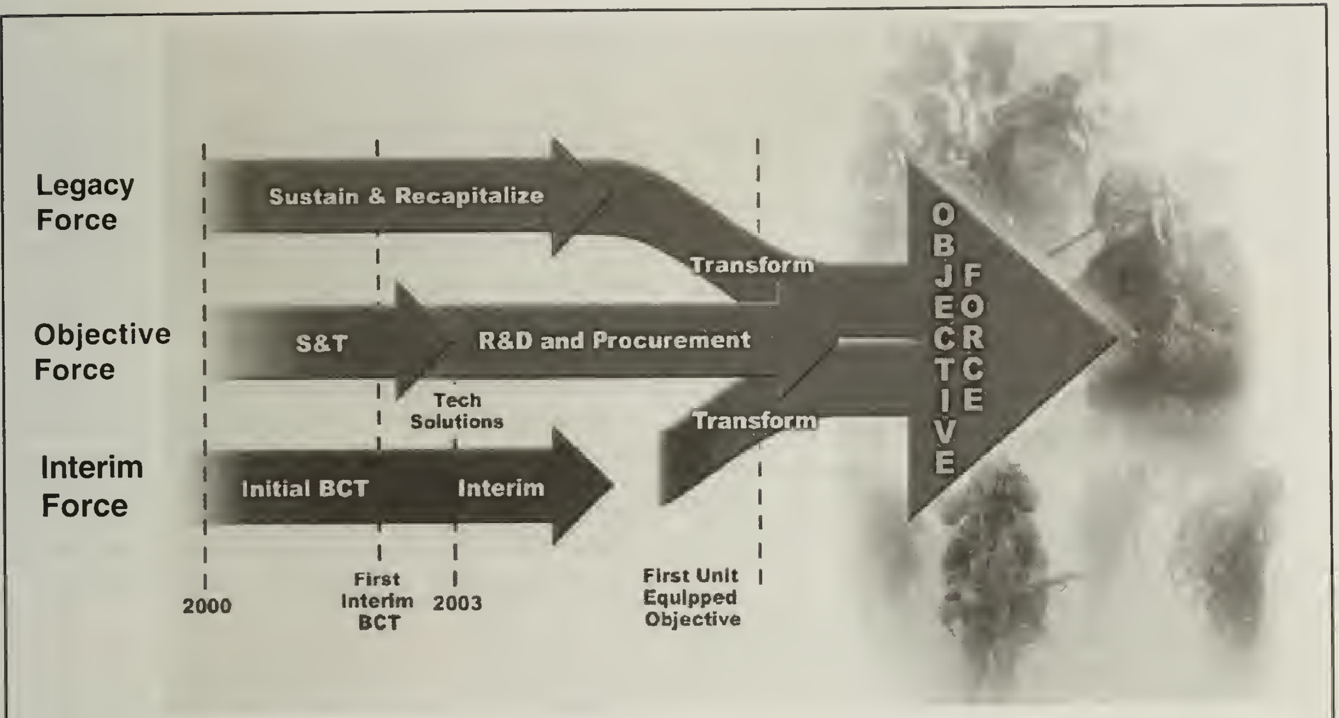
An improved mine-clearing line charge (MICLIC). It should be survivable and simpler and capable of being pulled by a variety of vehicles. The currently planned Mongoose system should provide this capability.

Note: As we move to make ourselves more versatile, we will encounter significant training challenges. As a result, future systems should be designed to be as simple to operate and maintain as possible. This and ensuring that squads and platoons are properly sized are really the keys to versatility. We can also develop innovative training strategies, such as using civilian technical colleges and two-week courses at Fort Leonard Wood or other installations, to take some of the training burden off the units. It is typically the leaders' inability to train soldiers on a wide variety of equipment, rather than the soldiers' ability to learn, that limits what our units can do.

Possible Future Structures

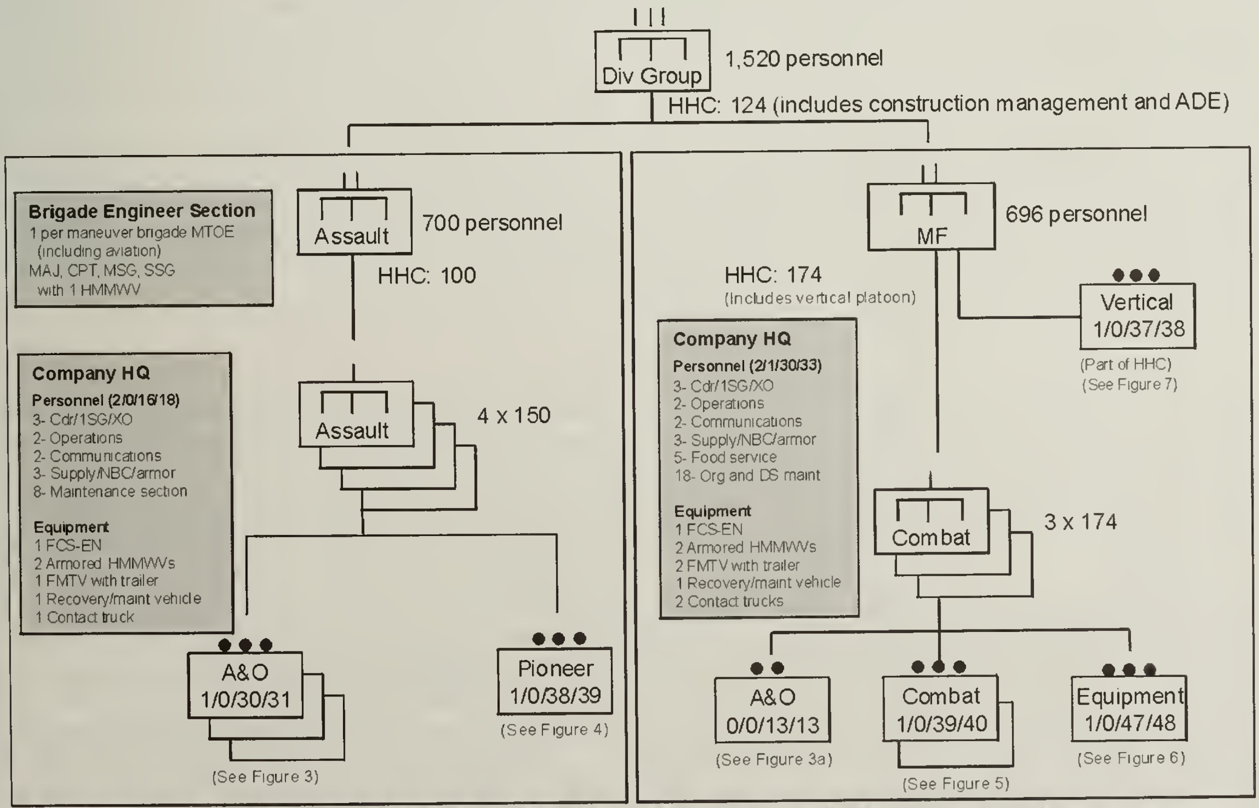
The Army has developed its modernization strategy to reach its objective force as shown in Figure 1. While we sustain and recapitalize selected "legacy" forces, we will concurrently develop interim medium brigade combat teams and interim divisions. We will take advantage of current science and technology (S&T) for our interim forces and future research and development (R&D) to reach our objective force. This objective force will have the same or greater firepower and survivability as current heavy forces but will be much lighter and deployable, using 20-ton vehicles versus the 70 tons of today's M1 main battle tank. As the objective force is fielded, legacy and interim forces will be transformed into the objective design. Engineers can best support this plan by utilizing the seven recommendations previously described. Based on this, I recommend that we look at doing the following:

1. Field assault companies for the IBCTs (now to 2002). (See assault battalion in Figure 2.) While this organization is larger than the company currently proposed, the three assault and



...Responsive, Deployable, Agile, Versatile, Lethal, Survivable, Sustainable.

Figure 1. The Army Transformation



Separate maneuver brigades, including the medium brigade, should have the same basic structure as the 150-man assault company.

This multifunctional (MF) (combat/construction) battalion provides tremendous versatility to the division. Divisional and EAD MF battalions are the same.

Figure 2. Standard Divisional Engineer Group Structure

obstacle (A&O) platoons (Figure 3) teamed with the pioneer platoon (Figure 4) provide the BCT with critical assault engineering support but are also versatile enough to support a broad range of missions. With this company, the BCT is more agile. It can go in early and support RSOI as well as stability, defensive, and offensive operations. Requiring less corps augmentation, it will be more deployable and sustainable than smaller, less versatile designs.

2. Field engineer groups with the interim divisions that have one assault battalion and one multifunctional (combat and construction) battalion (2003 to 2007). (See Figures 2 to 7, pages 9 and 11 to 13.)

- The assault battalion provides four small, yet capable, companies. Three of them can be normally associated with the three ground maneuver brigades. The fourth company can reinforce the main effort or support the aviation brigade.
- Figure 3a and Figures 5 and 6, page 12, respectively depict the A&O section, two combat-engineer platoons, and the equipment platoon found in the multifunctional battalion's line companies. Figure 7, page 13, depicts the vertical platoon found in the battalion HHC.

Figure 8, page 13, compares the current heavy divisional brigade with the proposed medium divisional group. The comparison shows that the proposed group has virtually the same assault capabilities as the divisional engineer brigade. (The loss of AVLBs is more than made up for by the ability to air assault Class 20 bridge sections that would be managed as a supply commodity.) However, the proposed group has far greater horizontal and vertical construction capabilities. The increase of 151 personnel is a result of making robust squads and platoons that are fully capable of operating and maintaining equipment 24 hours a day. In addition, the proposed group has most of the combat-engineer squads in the multifunctional battalion where their versatility can be fully utilized. This group is fully capable of supporting a broad range of missions without corps augmentation but can also command and control EAD assets without having to bring in a second O-6 group headquarters. The multifunctional battalion's HHC includes a construction-management section with design, survey, and materials-testing capabilities. As such, it can maintain and repair aerial ports and seaports of debarkation, MSRs, and lodgment areas with or without augmentation, depending on the amount of effort required.

The Army currently has two AC corps airborne battalions and three RC corps light battalions that are organized similarly to this design (including the A&O section—called a mobility/countermobility section). The design depicted here has larger squads and platoons; FCS-EN personnel carriers with dump trailers instead of 5-ton dumps as troop carriers; and a mixture of current equipment and new medium equipment such as a D6 dozer, a medium PLS, and an excavator (all less than 20 tons). The result is a fully air-deployable and air-assaultable force with excellent combat-engineering, force-protection, and firepower capabilities as well as horizontal construction capabilities similar to that of a combat-heavy battalion and a significant vertical capability from the vertical platoon and six combat platoons.

Note: Since interim divisional groups may not have a fielded IFV-EN dump trailer, a short-term solution would be to provide each combat-platoon headquarters an FMTV dump with a skid steer on a trailer. This vehicle could be hardened with ballistic glass and selected armor similar to a HMMWV's armor for improved survivability. It should also have a ring mount for MK19s or other automatic weapons (as should most of our trucks and HMMWVs).

If Army force developers balk at making the multifunctional battalion organic to the division, the multifunctional battalion could simply be assigned to the division for training purposes but remain an EAD asset. This is currently done with light equipment and CSE companies. It is key, however, that the division retain the C2 provided by the group headquarters in order to rapidly plan and conduct contingency operations.

3. Convert legacy light and heavy divisions to a similar two-battalion group (2003 to 2007). This would move the legacy organizations more in line with General Shinseki's vision of versatility and agility. The unit's current equipment and that found in current EAD battalions could be used for an interim organization. This would then be replaced by medium versions as the parent division was transformed into an objective division. This conversion would require equipment and personnel to be shifted from current EAD units such as corps airborne for light/airborne/air-assault divisions and combat-heavy for heavy divisions. Since so much of our active force currently resides in the heavy-division engineer brigades, standing up medium interim divisions with two-battalion groups will affect the entire force. Key decisions will have to be made on what units will be AC, RC, and multicomponent. That is why better integration of AC and RC structures is so important.

4. Convert corps combat-heavy, mechanized, and wheeled battalions to interim multifunctional battalions (same as the divisional group's multifunctional battalion) (2003 to 2007). Initially, an interim multifunctional battalion would be formed using current equipment (5-ton dumps as a squad vehicle and D7s). General-construction (vertical) platoons would be converted to combat platoons in the line companies. A vertical platoon would be added to the HHC in the combat-heavy battalions. Wheeled battalions would lose the third combat platoon per company but would gain horizontal and vertical capabilities. Mechanized battalions would retain most of their combat capabilities while gaining much greater horizontal and vertical capabilities. As current equipment is replaced, new equipment would be less than 20 tons (D6s replacing D7s). As mentioned above for the divisional combat battalion, these interim battalions would have to add a 5-ton dump with a skid steer on a trailer until a dump trailer with insert is developed. Before a medium CEV breacher is fielded to EAD units, an interim A&O section could be created using 5-ton dump trucks to haul MICLICs/Mongooses and Volcanos. Just as with the

Figure 3a. Assault & Obstacle Section
(In a multifunctional battalion line company)

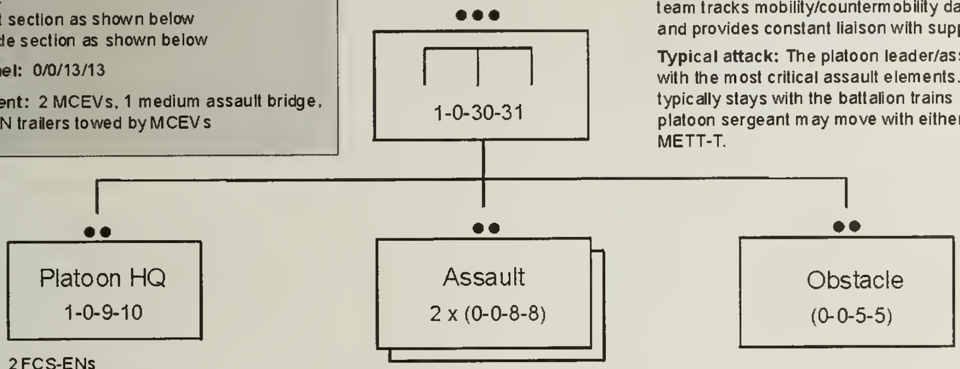
Includes:
1 Assault section as shown below
1 Obstacle section as shown below

Personnel: 0/0/13/13

Equipment: 2 MCEVs, 1 medium assault bridge, 2 FCS-EN trailers towed by MCEVs

Mission: Move with maneuver battalions in the attack, breach obstacles, and support a hasty defense. They are reinforced by the pioneer platoon and multifunctional battalion for defense. The liaison officer (LO) team in the platoon HQ can move as part of the task-force HQ. The team tracks mobility/countermobility data for the task force and provides constant liaison with supporting engineers.

Typical attack: The platoon leader/assault sections move with the most critical assault elements. The obstacle section typically stays with the battalion trains until needed. The platoon sergeant may move with either section based on the METT-T.



2 FCS-ENs
2 FCS-EN trailer

1 Platoon leader (PL)
1 Platoon sergeant (PS)
1 HQ squad leader/LO (SSG)
1 Asst LO (SPC)
4 Drivers/gunners
2 Combat engineers

Note: Attached medics, mechanics, or 12Bs would also ride in the back of the FCS.

2 x

Per Section:

2 MCEVs
(include marking system and towing system
1 Medium assault bridge
(medium AVLB or towed and launched from trailer)
2 FCS-EN trailers with MICLIC/Mongoose inserts
(towed by MCEVs or PL/PS FCS-EN)

3-Man crew/CEV
2-Man crew/medium assault bridge

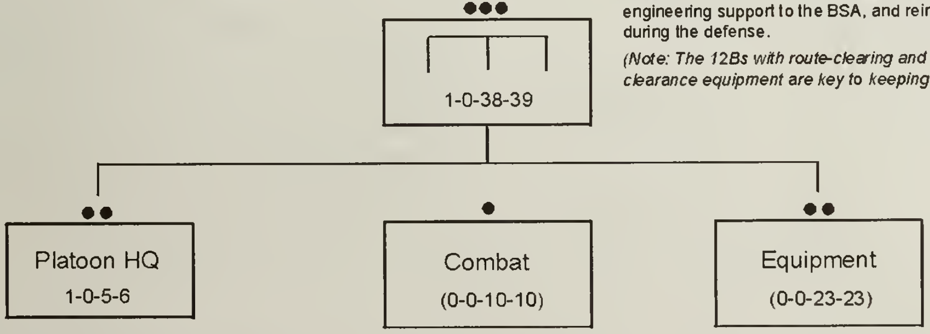
1 Medium PLS with 2 Volcanos
(could also carry additional MICLIC/Mongoose)
1 SEE variant with fencing machine

3-Man crew for PLS with Volcanos
2-Man crew for SEE variant

Figure 3. Assault and Obstacle Platoon (Divisional Assault Battalion)

Mission: Reduce breached obstacles along key routes, maintain MSRs, provide survivability and general-engineering support to the BSA, and reinforce A&O platoons during the defense.

(Note: The 12Bs with route-clearing and lane-widening/area-clearance equipment are key to keeping MSRs open.)



2 FCS-ENs
2 FCS-EN trailers with countermine inserts
(can also carry Volcano system in trailer)

1 Platoon leader (PL) (LT)
1 Platoon sergeant (PS)
4 Drivers/gunners

Notes: The two FCS-ENs with countermine inserts give the pioneer platoon its route-clearing and obstacle-reduction capabilities and provide excellent force protection and firepower.

The combat squad can assist with route clearance and support the equipment section with culverts and simple vertical construction.

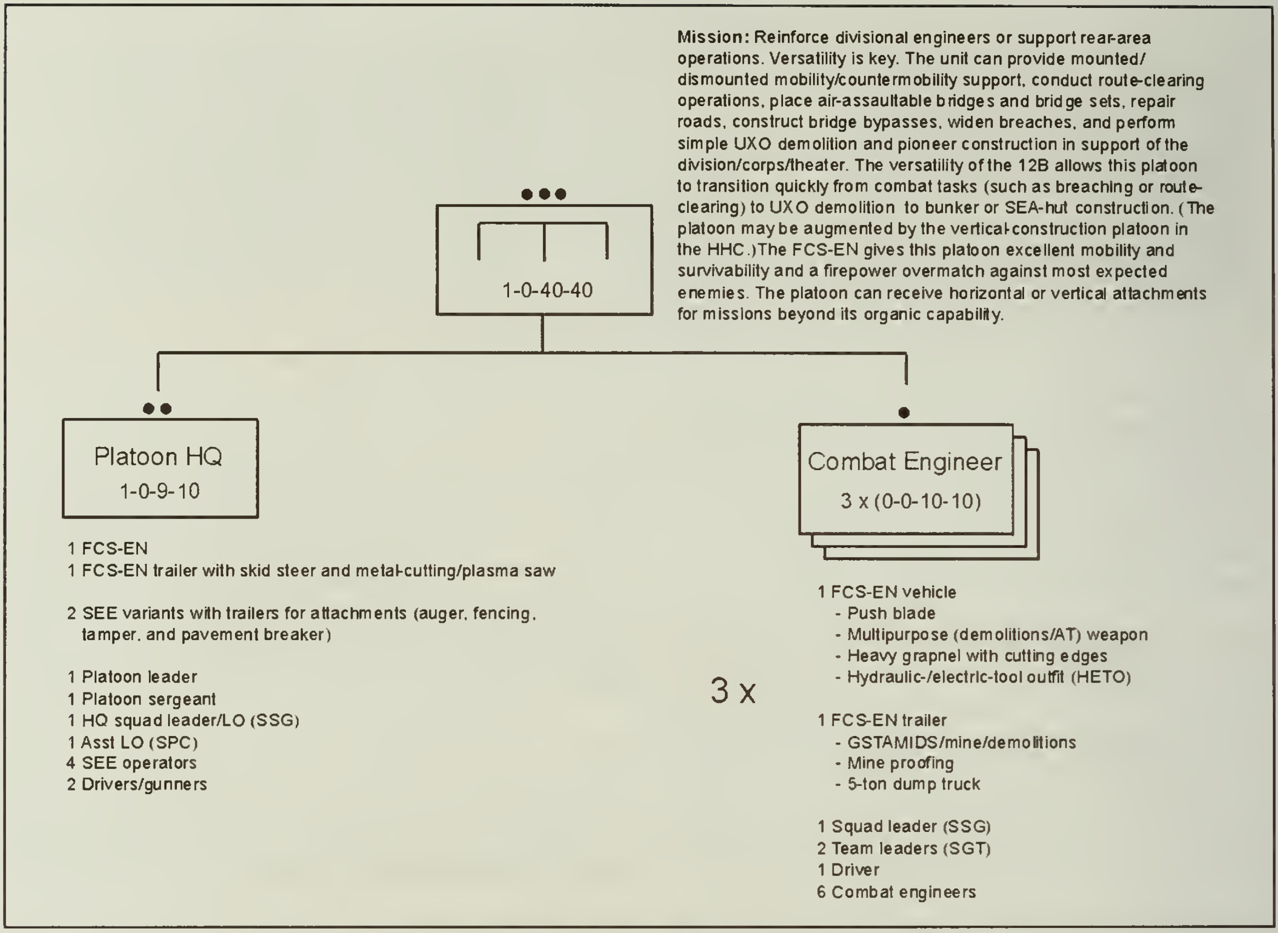
The combat squad can also be air-assaulted for demolition/mine missions.

Moves in the PL/PS FCS-EN or with equipment platoon FMTVs

1 Squad leader
2 Team leaders
7 Combat engineers

3 DEUCE variants (mobile blades)
(armor kits/ballistic glass optional)
2 D6s (air-assaultable JTR)
2 Medium PLSs to haul D6s
(could also accept dump and other PLS modules)
2 FMTV dumps
2 Trailers with skid steers and attachments
(skid steers can load FMTV, PLS, and FCS-EN trailer dumps)
2 SEE variants with trailers for attachments

Figure 4. Pioneer Platoon (Divisional Assault Battalion)



Mission: Reinforce divisional engineers or support rear-area operations. Versatility is key. The unit can provide mounted/dismounted mobility/countermobility support, conduct route-clearing operations, place air-assaultable bridges and bridge sets, repair roads, construct bridge bypasses, widen breaches, and perform simple UXO demolition and pioneer construction in support of the division/corps/theater. The versatility of the 12B allows this platoon to transition quickly from combat tasks (such as breaching or route-clearing) to UXO demolition to bunker or SEA-hut construction. (The platoon may be augmented by the vertical-construction platoon in the HHC.)The FCS-EN gives this platoon excellent mobility and survivability and a firepower overmatch against most expected enemies. The platoon can receive horizontal or vertical attachments for missions beyond its organic capability.

1 FCS-EN
1 FCS-EN trailer with skid steer and metal-cutting/plasma saw

2 SEE variants with trailers for attachments (auger, fencing, tamper, and pavement breaker)

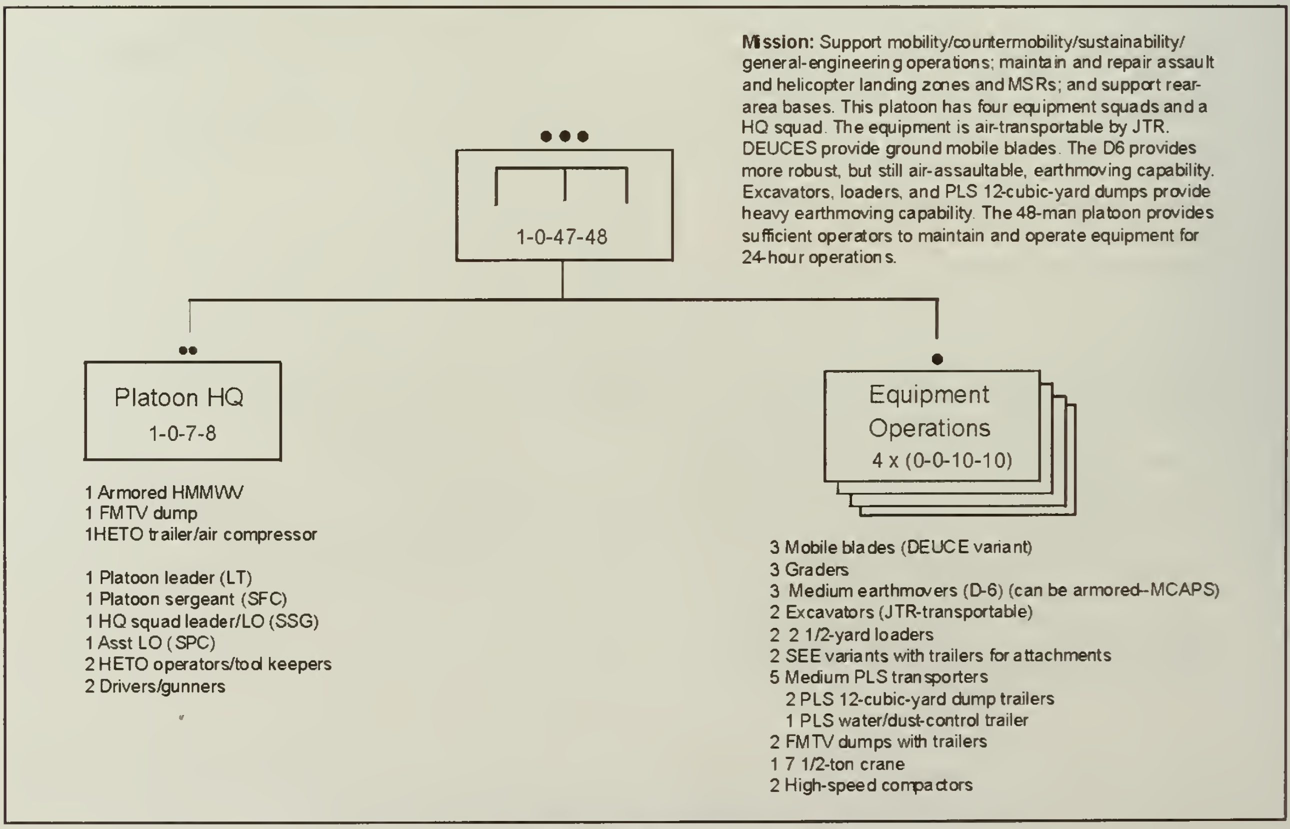
1 Platoon leader
1 Platoon sergeant
1 HQ squad leader/LO (SSG)
1 Asst LO (SPC)
4 SEE operators
2 Drivers/gunners

1 FCS-EN vehicle
- Push blade
- Multipurpose (demolitions/AT) weapon
- Heavy grapnel with cutting edges
- Hydraulic-/electric-tool outfit (HETO)

1 FCS-EN trailer
- GSTAMIDS/mine/demolitions
- Mine proofing
- 5-ton dump truck

1 Squad leader (SSG)
2 Team leaders (SGT)
1 Driver
6 Combat engineers

Figure 5. Combat-Engineer Platoon (Multifunctional Engineer Battalion)



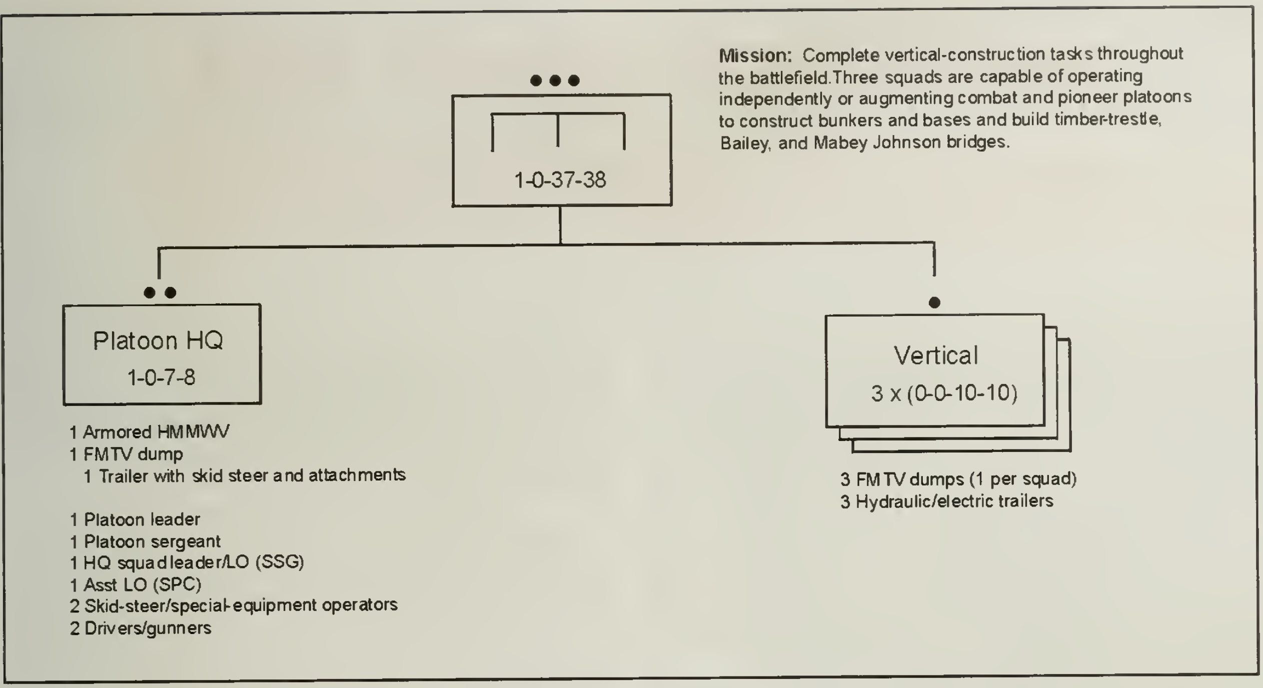
Mission: Support mobility/countermobility/sustainability/general-engineering operations; maintain and repair assault and helicopter landing zones and MSRs; and support rear-area bases. This platoon has four equipment squads and a HQ squad. The equipment is air-transportable by JTR. DEUCES provide ground mobile blades. The D6 provides more robust, but still air-assaultable, earthmoving capability. Excavators, loaders, and PLS 12-cubic-yard dumps provide heavy earthmoving capability. The 48-man platoon provides sufficient operators to maintain and operate equipment for 24-hour operations.

1 Armored HMMWV
1 FMTV dump
1HETO trailer/air compressor

1 Platoon leader (LT)
1 Platoon sergeant (SFC)
1 HQ squad leader/LO (SSG)
1 Asst LO (SPC)
2 HETO operators/tool keepers
2 Drivers/gunners

3 Mobile blades (DEUCE variant)
3 Graders
3 Medium earthmovers (D-6) (can be armored--MCAPS)
2 Excavators (JTR-transportable)
2 2 1/2-yard loaders
2 SEE variants with trailers for attachments
5 Medium PLS transporters
  2 PLS 12-cubic-yard dump trailers
  1 PLS water/dust-control trailer
2 FMTV dumps with trailers
1 7 1/2-ton crane
2 High-speed compactors

Figure 6. Equipment Platoon (Multifunctional Engineer Battalion)



Mission: Complete vertical-construction tasks throughout the battlefield. Three squads are capable of operating independently or augmenting combat and pioneer platoons to construct bunkers and bases and build timber-trestle, Bailey, and Mabey Johnson bridges.

1 Armored HMMWV
1 FMTV dump
  1 Trailer with skid steer and attachments

1 Platoon leader
1 Platoon sergeant
1 HQ squad leader/LO (SSG)
1 Asst LO (SPC)
2 Skid-steer/special-equipment operators
2 Drivers/gunners

3 FMTV dumps (1 per squad)
3 Hydraulic/electric trailers

Figure 7. Vertical Platoon (Multifunctional Engineer Battalion)

Major Systems	Current Heavy Battalion	Current Heavy Div Engr Brigade	Proposed Assault Battalion	Proposed MF Battalion	Proposed Div Group (d+e+HHC)	Delta Current-Proposed (f-c)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
ACE/DEUCE variants	21	63	0	9	9	-54
MCEVs	0	0	48	6	54	+54
APC/FCS-ENs	28	84	32	24	56	-28
FCS-EN dump trailers	0	0	32	24	56	+56
MICLICs/Mongooses	12	36	48	6	54	+18
Volcanos	6	18	24	6	30	+12
AVLBs/Med assault bridges	12	36	24	3	27	-9
Graders	0	0	0	9	9	+9
SEE variants	6	18	20	21	41	+23
D6 dozers	0	0	8	9	17	+17
High-speed excavators	0	0	0	6	6	+6
Med PLS equipment haulers	0	0	20	18	38	+38
PLS dump racks	0	0	0	6	6	+6
PLS water distributors	0	0	0	3	3	+3
FMTV dumps	0	0	8	13	21	+21
Cranes	0	0	0	3	3	+3
Skid steers	0	0	8	7	15	+15
Personnel	429	1,369	700	696	1,520	+151

Notes:

1. *All equipment for medium assault battalions and multifunctional battalions weighs less than 20 tons and is therefore air assaultable by JTR and transportable by C-17s and C-130s (newer versions). This not only allows the force to deploy by air but also gives it tremendous capabilty to move quickly to where it is needed by air assault.*
2. *The proposed divisional group has more personnel than the curent heavy divisional brigade because it has more robust squads, platoons, and headquarters. It is much more capable of 24-hour operations and has equipment to support combat operations; maintain and repair aerial ports of debarkation and MSRs; and support RSOI, force buildup, logistics, and other bases.*

Bottom line: It is a versatile and agile organization.

Figure 8. A Companion of Major Engineer Systems of the Current Heavy Divisional Engineer Brigade and the Proposed Two-Battalion Group

interim combat platoon, these 5-ton dumps could be hardened with ballistic glass, armored cabs, and applique bottom and side armor. With a ring-mounted MK19, this would be a vast improvement in survivability and firepower over current 5-ton dump trucks.

5. Create vertical companies and merge current CSE, dump, and CSC into one type of separate horizontal company (2003 to 2007). Separate paving and quarry detachments would also be retained. The vertical separate companies would work primarily in nation/humanitarian assistance and rear-area bases. They would become building experts similar to prime-power platoons. These separate companies—along with already existing bridge companies—could work independently but more often would work under the control of a multifunctional battalion for design, testing, management support, and security. They should be assigned to a multifunctional battalion in peacetime for the same support.

6. Replace interim equipment with objective-force equipment as technology and funds allow (2007 to 2030). It is important to restructure sooner than later. This will help us avoid replacing/maintaining overaged equipment and units that we no longer need. We will undoubtedly lose battalion and higher headquarters in order to build units that are more robust at the execution level. While painful, this is the right thing to do—the fewer units we have to deploy, the less unit C2 "overhead" will have to be deployed with them. Early conversion will then allow us to focus on developing the equipment and fine tuning interim organizations in order to reach the objective force. A reasonable goal would be to field the first objective force engineer units in 2010. Interim units would then receive objective equipment as funds allow from 2010 to 2030.

Note: While putting a bridge company back in the division is tempting, we should avoid doing so since bridge companies are primarily single-purpose units and would not be needed for many contingencies. Also, bridging does not require extensive combined-arms training with the supported maneuver unit. We would be better off keeping bridge companies (active and reserve) as EAD assets. We should also ensure that sufficient bridge sets (such as the Class 20 described above, the Bailey, and the Mabey Johnson) are available for rapid forward delivery and emplacement by the divisional assault and combat battalions, or multifunctional EAD battalions.

Seize the Initiative

The engineer organizations and changes described in this article clearly support General Shinseki's vision:

Responsive and deployable. The medium division with its engineer group can deploy and conduct a wide range of missions with less EAD augmentation than current structures. The robust squads and platoons will be fully capable of 24-hour operations and therefore ensure that we get the most out of our deployed equipment.

Agile. Medium divisional engineers and EAD multifunctional battalions will be able to rapidly change from construction to combat operations and back again. The simplified, but more robust, C2 structure in the division and corps would allow deploying forces to keep the same engineer C2 team that they have trained with.

Versatile. Both divisional and corps engineers would be much more capable of supporting a full spectrum of operations. This versatility means that fewer types, and numbers, of engineers must be deployed. Integrating RC engineers into C2 headquarters at the division and corps levels allows us to take better advantage of the tremendous technical capabilities found in the RC. We can therefore provide better construction management, which is the key engineer mission in many low-intensity scenarios.

Lethal and Survivable. Multifunctional battalions (with IFV/FCSs) that replace combat-heavy and wheeled battalions will be much more capable of defending themselves and supporting combat operations, while still having excellent sustainment-engineering capabilities. The additional dig assets in the two-battalion group will also provide much greater survivability support to the division.

Sustainable. By making the divisional and corps engineers more versatile, and thereby reducing the number of corps engineers required, the deployed force is smaller and more easily sustained. The multifunctional battalions in the divisions and the EAD multifunctional battalions ensure that MSRs and aerial ports and seaports of debarkation remain open and keep logistics traffic flowing.

While our challenges may be great, so are our opportunities. If we seize the initiative by voluntarily reorganizing significant portions of the engineer corps to better support the Army's vision, we can control our own destiny and win future resource fights.

Lieutenant Colonel Lindsay is the Assistant Corps Engineer for the XVIII Airborne Corps. He has served with the 27th Engineer Battalion (Corps)(Airborne), the 13th Engineer Battalion/7th Infantry Division, the 36th Engineer Group (Construction) in Somalia, and the 20th Engineer Brigade (Combat)(Airborne Corps). LTC Lindsay also has served with the Nashville District, U.S. Army Corps of Engineers, as a facilities engineer in Hohenfels, Germany; and as an AC/RC advisor to a combat heavy battalion, an engineer group, and a theater Army brigade. He holds a master's in civil engineering from Vanderbilt University and is a registered professional engineer in Virginia.

The Army Facilities Components System

By Edward Scott

During World War II, it became apparent that the Army needed an improved emergency construction-support system to enhance planning and execution of the construction missions in the theater of operations. The goal was to develop standard designs and provide a common base for planning, logistics support, and construction.

In 1951, the Office of the Chief of Engineers developed a system to facilitate planning and to serve as a construction guide to engineer field units. The system, the Engineer Functional Components System—later called the Army Facilities Components System (AFCS)—was established as a set of standard facility designs, managed and supported at the U.S. Army Corps of Engineers headquarters.

The AFCS design-and-support mission transferred to the U.S. Army Engineering and Support Center in Huntsville, Alabama, in 1978. Program management remains at the Corps's headquarters. The AFCS is an engineering construction-support program for Army mission construction in a theater of operations and for other OCONUS requirements. It also supports emergency construction during disaster relief in any area when required and also supports worldwide humanitarian-relief efforts.

The system was used in support of Operations Restore Hope in Somalia, Uphold Democracy in Haiti, Joint Endeavor/Joint Guard in Bosnia, and Allied Force in Kosovo. The AFCS provides planning guidance, construction drawings, bills of material, and labor and equipment estimates. The Huntsville Center's mission is to maintain and modernize the information contained in the system and to distribute it to all military engineer units on the distribution list or that request the system (see article, page 16). Although the AFCS is updated continuously, the system is sent to engineers annually.

Until 1995, a series of 11 Army technical manuals provided AFCS designs and related information to military engineers. All the information from these technical manuals is now available on a compact disk that can be used on common office computer equipment. This user system is the Theater Construction Management System (TCMS) (see sidebar, page 17).

In addition to the AFCS design drawings and related data, the TCMS includes commercial software and government-developed programming to facilitate planning, logistics coordination, design, site adaptation, communication, construction management, and reporting. The AFCS includes construction drawings and computerized information for about 4,400 facility designs and 750 installation designs. Some of the designs included in the system are troop camps, hospitals, bridges, marine terminals, and ammunition storage facilities.

A soldier uses the TCMS to locate plans for a construction project.

This system not only eliminates the time it normally would take to design a facility but also provides soldiers with a wealth of information.

Among the Huntsville Center's AFCS responsibilities are to—

- Develop budgets.
- Prepare and conduct industrial advancements in technology.
- Plan projects and programs.
- Arrange and monitor periodic exercises of the system.
- Develop and coordinate scopes of work.
- Negotiate and award design contracts.
- Prepare designs, bills of material, and labor and equipment estimates.
- Review designs for technical and functional adequacy.
- Provide automation support for AFCS and TCMS programs.
- Coordinate work with the Corps's labs.

For more information about the Army Facilities Components System, contact Edward Scott at (256) 895-1781.

Mr. Scott, a supervisory mechanical engineer, is the AFCS Branch Chief and project manager for the AFCS/TCMS program.

Updating the Army Facilities Components System

By Lieutenant Colonel Robert C. Steiger

While the World War II-era wooden theater-of-operations buildings are almost a thing of the past on Army bases today, the designs still live on in the Army Facilities Components System's (AFCS's) family of documents. However, the 416th Engineer Command (ENCOM), Darien, Illinois, is leading a project to modernize some of the AFCS designs. The AFCS is the military engineering construction-support system for planning and executing theater-of-operations construction. To the average engineer soldier, it is still a catalog of Army designs for facilities such as base camps and components such as guard towers.

The project to modernize some of the AFCS designs has two parts. First, add to the AFCS-specific designs for Southwest Asia facilities and components, such as sunshades, that are not found in the AFCS today. Second, modify some existing designs to use alternative construction materials that are more prevalent, are available faster, and cost less in the Southwest Asia area of operation. We are focusing on replacing lumber with materials such as concrete-masonry-unit block, plastic or steel pipe, and fabric.

The Beginning

This project originated in late 1998, when part of the 416th ENCOM's Forward Cell deployed to Kuwait to support Army Central Command (ARCENT)—the Army's component of Central Command (CENTCOM)—during Operation Desert Fox. This operation, the response to Iraq's threats toward Kuwait, involved the deployment of more than 4,000 soldiers to Kuwait to build a deterrence force. The Forward Cell was involved in providing facilities for the reception, staging, and onward integration (RSOI) of the soldiers.

We turned to the AFCS for already designed facilities and components but found them unable to meet the needs of the deterrence force. The AFCS designs for facilities to support troops in the field—such as field showers, latrines, guard towers, and administration buildings—were too lumber-intensive and too permanent. The designs were for "temporary" facilities, with a useful life of at least 24 months. What we needed were facilities that met the "initial" standard, with a useful life of 1 to 6 months.

The AFCS had not been updated to include the facility components designed and built during and after Operations Desert Shield and Desert Storm that were Southwest Asia-specific. We couldn't even find designs for some basic facilities that we needed. So ARCENT and the 416th ENCOM had to quickly redevelop designs, specifications, and scopes of work for initial standard facilities and components.

The Project

The after-action report for Operation Desert Fox recommended that designs for RSOI facilities applicable to the Southwest Asian environment be institutionalized. The report specified that designs for both initial and temporary facilities (as defined in Joint Chiefs of Staff Pamphlet 4-04, *Joint Doctrine for Civil Engineering Support*) be included.

In addition, the CENTCOM Engineer Working Group (composed of engineers from all of CENTCOM's subordinate services) also recommended that the AFCS designs be updated and modified to use alternative construction materials and techniques found in Southwest Asia and asked that force protection be included. We nicknamed the project the "Top 20 Project," because we focused on 20 generic facilities and components that are used most by all services (Army, Navy, Air Force, and Marines) in Southwest Asia. Examples are sunshades, showers, latrines, and maintenance hardstands.

Involved in this project are the U.S. Army Corps of Engineers (USACE) Transatlantic Program Center (TAC); the Engineering and Support Center at the Huntsville, Alabama, Division of the Corps of Engineers; the 416th ENCOM's Forward Cell; and the 416th ENCOM's facilities engineering design team. The TAC provides engineering, construction, and contracting services for the Army and Air Force in CENTCOM's area of responsibility and beyond. It is the best source of institutional knowledge of U.S. government-financed or -managed construction in the Middle East. Its forerunner, the Middle East/Africa Program Office, was a key element in the USACE's engineering and construction accomplishments before and during Operations Desert Shield and Desert Storm.

Huntsville's Engineering and Support Center developed and manages the PC-based Theater Construction Management System (TCMS) for construction planning, designing, managing, and reporting (see sidebar). The TCMS, which is used for contingency construction, has proven to be an important system for engineer brigades, groups, and battalions. To find the AFCS drawings and specifications, it is no longer necessary to leaf through the large paper Technical Manuals 5-301 and 5-302, *Army Facilities Components System–Designs;* and 5-303, *Army Facilities Components System–Logistics Data and Bills of Materiel.* Now, units can load the TCMS program and, with AutoCAD® LT, pull up the complete design packages and even issue construction directives from the program. The TCMS makes it easier to ensure faster distribution and use of the latest AFCS changes.

When the 416th ENCOM began the project to update the AFCS designs, the first step was to solicit input from each of the services as to its recommendations for the 20 most used generic facilities and components. We found that we really needed to expand the number beyond 20 to capture all of the most frequently used facilities (see chart, page 18).

The next step was to contact the TAC to see what designs existed for facilities or components constructed during or since Operations Desert Shield and Desert Storm, such as sunshades, that met our requirements. The TAC had a plethora of designs for temporary standard and permanent facilities but very few that could meet the austere design criteria for the initial standard. We contacted personnel at Huntsville's Engineering and Support Center to inform them of this project and find out how difficult it would be to modify the TCMS and the AFCS to add these Southwest Asia-specific facilities and components to the family of designs. Personnel at the center were very responsive and eager to add these facilities.

The project officer for the Top 20 Project then assigned a source of the design, specifications, and bill of materials (BOM) to each of the items. For some items, we could quickly procure the design from TAC because it had already been used in the area of operations to build a facility or component. All the 416th ENCOM had to do was produce the specifications and check the BOM. For many other items, we turned to our facilities engineering design team to either modify an existing design or complete the package for an existing design by developing the specifications and BOM.

A good example of this is the familiar "burnout latrine" from the Vietnam War. The design was modified to replace some wood structural members with plastic or steel pipe. The walls are no longer plywood but are fabric—whatever locally made fabric is available. Although we haven't totally eliminated wood in the projects, we have drastically reduced the amount of plywood needed.

As each design package is finished, engineers with area-of-operations experience review the package to ensure that it is complete and understandable. To date, the 416th ENCOM has completed three of the design packages and is staffing them. The next step is to electronically send each design package to Huntsville to be included in the next versions of TCMS software. So start looking for the first of the new Southwest Asia-specific design packages later this year.

The Results

By modernizing some of the AFCS designs with the Top 20 Project, the 416th ENCOM, the Transatlantic Program Center, and Huntsville's Engineering and Support Center are on the way to making it easier for engineers deploying to Southwest Asia to provide facilities and components to deployed soldiers much faster than before.

Lieutenant Colonel Steiger is a team leader in the 416th ENCOM Forward Cell, Atlanta, Georgia. He previously commanded the 391st Engineer Battalion, Greenville, South Carolina. A graduate of the Command and General Staff Course and the Armor and Engineer Officer Advanced Courses, LTC Steiger holds a master's degree in business administration from Duke University, Durham, North Carolina.

Theater Construction Management System

By Sergeant First Class Brian Nering

Modern Army engineers have a multitude of automated aids to make their job easier. The Theater Construction Management System (TCMS) is one of these aids. Used in conjunction with AutoCAD® LT, the TCMS is a computer-based system for planning construction projects. The system includes design, management, and reporting capabilities.

The TCMS was designed to replace Technical Manuals 5-301 and 5-302, *Army Facilities Components System – Designs;* and 5–303, *Army Facilities Components System – Logistics Data and Bills of Materiel.* These manuals include "blueprints" and schedules for projects ranging from latrines to base camps. The goal was to provide construction units with examples of projects that had already been used in the field. In other words, civil engineers would not have to design a base camp from scratch; they would simply copy the required drawings, make any necessary changes, and start building.

The primary military occupational specialty involved is 51T, technical engineer. The 51T course is taught at Fort Leonard Wood, Missouri, to members of all branches of the military. The 18-week, technically intense advanced-individual-training course is comprised of drafting, surveying, and materials-testing skills. At the beginner level (10), students are taught to search, modify, and print drawings properly. Considering the current inventory of 4,800 plans to choose from, proper search techniques are critical.

In the TCMS—under the "Facilities" pull-down menu—type either a "noun" or short "description" to search for like projects. After locating the desired project, open the drawing file in AutoCAD LT and save it as a separate file. Then changes can be made to the drawing for site conditions or other requirements specific to that project. Currently, personnel at the staff-sergeant level (30) are responsible for determining required changes. The next step is to generate a bill of materials (BOM) needed to build the structure.

It's easy to see how the TCMS has become a time and labor saver. Projects that once required cumbersome technical manuals and a chest of flat files are now on a CD. As always, time is a valuable asset to mission accomplishment, and the TCMS is now "time saved" for the military.

Sergeant First Class Nering is the Program of Instruction Manager for MOS 51T, Directorate of Training Development, U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri.

Top "20" Projects
Southwest Asia Area of Operations

	Project	Description	Concept
1	Aircraft maintenance	An arch-span metal building	Various aircraft sizes
2	Ammunition supply point	An earth-barricaded ammunition-storage point	
3	Barriers	A concrete vehicle-barrier checkpoint	Placed at gate entrances; reinforced concrete; relocatable; "Jersey" and "Texas" sizes (3 feet and 6 feet high)
	Barriers	A 55-gallon drum vehicle-barrier checkpoint	Placed at gate entrances; filled with water; relocatable
4	Base-camp layout	A site-layout design for a 1,000-man Kaabal	Layout using the above facilities
5	Berms	Perimeter base-camp berms	Six-foot-high earth berms to provide blast protection and wheeled-vehicle barrier
	Berms	Aircraft, helicopter, and Patriot battery protection	Eight-foot-high, sand-grid walls or fabric-lined wire baskets (filled with sand and gravel)
6	Bulk fuel	A bulk-fuel storage and transfer point	Inland petroleum-distribution system (IPDS) feed and truck feed, with earth berms for spill protection; unit provides collapsible bags, piping, and pumps
7	Bunkers	Protective personnel bunkers	SCUD bunkers; reinforced-concrete box culvert, 5 feet high, 8 inches thick, sandbag sides and top, sandbagged Jersey barriers on the ends
8	Displaced-civilian camp	A 5,000-man camp	Layout using the above facilities
9	Electrical-power grid and lights	Electrical-power grid and lighting for a 1,000-man Kaabal	Power cables elevated on timber scissors, with relocatable exterior lights; electricity from 2- by 100-kilowatt generators (1,650 amperes at 120 volts)
10	Enemy-prisoner-of-war camp	A 5,000-man camp	Layout using the above facilities
11	Hardstand	Rough-terrain forklift capable	An area 100 by 100 meters; gravel surface, 6 inches thick; upgrade with 6 inches of concrete
12	Helicopter fueling point	A forward-area arming and refuel point (FAARP)	CH-47-capable, using dust palliatives for dust control
13	Helicopter landing pad	CH-47- and UH-60-capable versions	A concrete pad, 8 inches thick, with tie-downs; dust palliative around pad
14	Latrines	A three-hole field latrine	Wood frame; fabric siding; metal burnout barrels; relocatable
15	Latrines	A one-hole field latrine (foldable portatoilet)	Plastic siding, fabric hinges and snap construction for quick assembly; relocatable; requires sewage service
16	Latrines	A three-tube urinal	PVC pipe in gravel sump
17	Petroleum pipeline	An IPDS (pipeline)	
18	Shower/latrines	A shower/latrine trailer	Eight shower stalls and 8 toilet seats in a 40-foot trailer unit, with sinks and water heater; liftable; requires nonpotable running water, gray-water disposal, and sewage collection
	Showers	Two- and three-stall portable field showers	Wood frame; metal water storage; nonpotable water; relocatable; thermostat-controlled heating elements
19	Showers	Shower trailer	Sixteen shower stalls in a 40-foot trailer unit, with sinks, and water heater; liftable; requires nonpotable water and gray-water disposal
20	Sunscreens	Prefabricated metal building	Without walls; various sizes; capable of storing MILVANs stacked two high
21	Tent pads	A 4-inch gravel hardstand; upgrade with a 4-inch lean concrete slab for tent pads	Concrete pad kept thin and low strength to retain initial standard
22	Towers	Two-man guard/observation towers around perimeter and checkpoints	Steel frame preferred; 10-foot towers (from ground to top of floor); sandbagged sides and top
	Wash basins/shaving stands	Water tower	Steel frame preferred; for nonpotable water; unit provides a 3,000-gallon collapsible bladder; platform elevated to 10 feet

Letters To The Editor

U.S. Army Prime Power: A Tradition of Innovation and Excellence

I was very interested in an article in the July 2000 issue of *Engineer* by CW2 Andrew K. Potter ("U.S. Army Prime Power: A Tradition of Innovation and Excellence"), since it concerned the use of the nuclear power barge Sturgis during the period I worked at the Panama Canal.

Page 3 of the article indicates that the Sturgis was "... moored from 1968 to 1975 in the Panama Canal Zone, allowing the waters of Gatun Lake to be used for filling locks." Actually, the situation was much more complex. The Sturgis provided augmentation power-generation capacity to the entire Canal Zone, especially during the dry season, which allowed more of the water capacity of Gatun Lake to be used for navigation purposes rather than for hydroelectric power generation. Therefore, the lake could be kept at higher levels. This was critical during this period because of the emergence and growth of the "Panamax" container ship, which tested the draft and dimensional limits of the Canal.

The Sturgis provided a valuable service to the Canal operations but had no direct relationship to "filling the locks." Had the Sturgis not been in the Canal Zone during that time, more water would have been used for power generation. This would have lowered the level of Gatun Lake and reduced the allowable draft for transiting vessels, which would have resulted in fewer vessels transiting the Canal. The Sturgis was replaced by two 21-MW Hitachi turbines, one on the Pacific side of the Isthmus and one on the Atlantic side.

LaMar T. Sizemore, CPE
Deputy Director, Public Works
U.S. Army Aviation Center
Fort Rucker, Alabama

Maneuver Support Center's Reply

Thank you for your interest in Engineer *and the prime-power article. We appreciate your knowledge of the work in Panama and your taking time to comment on Gatun Lake and the Sturgis mission. We welcome the opportunity to learn more about the history of the prime-power battalion. It is a long and varied story, and contributions from people who have worked the mission are invaluable.*

CW2 Andrew K. Potter
Combat Developer

Route Reconnaissance: A Lost Art

An article entitled "Route Reconnaissance: A Lost Art" by Captain Matt Pasvogel in the April 2000 issue of Engineer instantly caught my eye. As a retired NCO, who was a reconnaissance NCO for the 802d Engineer Battalion in Korea and the 11th Engineer Battalion at Fort Belvoir, Virginia, I was impressed with the list of recon equipment in Figure 2, page 16. I didn't have a digital camera or a Global Positioning System back then (I wish I had). My measuring tape in Korea was metric, and I had to convert the formulas or measurements to accommodate the numbers in the formulas in FM 5-170, Engineer Reconnaissance, and FM 5-34, Engineer Field Data.

I recommend adding a Philly rod to the list of recon equipment. Used by surveyors when running levels and finding elevations, this rod also can be used with photographs of bridges to give some reference as to size. A picture of a bridge is fine, but without some way of determining the bridge's size, it is just a pretty picture.

Another useful piece of equipment to have on a recon mission is a stopwatch. You can measure off a certain distance along the bank of a stream or river and then drop a stick into the water at the upstream end and time how long it takes for the stick to travel the measured distance. Using the formulas in FM 5-34, the flow rate of the stream can be calculated. This is critical for determining a bridge bypass.

Mr. Laurie R. Benke II, CCI
Construction Representative
U.S. Army Eastern District Facilities Engineer
Kunsan Project Office, Korea

Engineer School's Reply

We appreciate your comments. They have been noted by the personnel who are upgrading the Field Sketch Set. Meanwhile, positioning a soldier in the digital photo would lend a sense of scale to the structure. The recon form itself requires scaled and/or dimensional drawings along with other critical information. And the GPS—the Precision Lightweight GPS Receiver (PLGR)—has a chronometer feature that digitally displays the current time in an hour-minute-second arrangement.

As a former reconnaissance NCO, you realize the impossibility of carrying all the items necessary to meet every contingency. In the future, Land Warrior capabilities will link video and audio responses of the recon team members directly to the intelligence-gathering headquarters. For those not so equipped, the Field Sketch Set is being modernized with a laptop, a digital camera, a GPS, and laser range-finding devices for reconnaissance and construction use as well as facilities management and contracting.

Alan Schlie
Force Development Analyst

Engineers Field the HYEX

By Carolee Nisbet

On 17 June, the 77th Regional Support Command, Fort Dix, New Jersey, celebrated the first acquisition of commercial hydraulic excavators (HYEXs) for an Army Reserve unit. Five of the HYEXs were added to the inventory of mission, training, and emergency-support equipment used by the 77th's 854th Engineer Battalion.

The commander of the 77th termed the new equipment a combat multiplier that will let soldiers of the 854th complete more missions faster and better. The HYEX is deployable, and it replaces 12 to 15 pieces of equipment in the unit's inventory that are obsolete. It gives the unit the ability to accomplish tasks that they couldn't do before.

The Army opted to switch to the new equipment to save time and money. It would often take as much as half a day to change the extensions on their old equipment, but now it takes less than five minutes. This decreases time spent on projects, which decreases project costs.

The 854th received three types of HYEXs:

- Type I, weighing in at 52,410 pounds, comes equipped with a hydraulic quick-disconnect coupler; a hydraulic thumb clamp; and heavy and utility buckets for general digging, trenching, and lifting.
- Type II, a slightly heftier 62,000 pounds, is equipped with a hydraulic quick-disconnect coupler, a hydraulic rock drill, and a heavy-duty bucket for quarry operations.
- Type III, the heavyweight of the trio at 71,900 pounds, is equipped with a hydraulic quick-disconnect coupler, a heavy-duty bucket, a rock bucket, and an impact breaker for use in quarry operations.

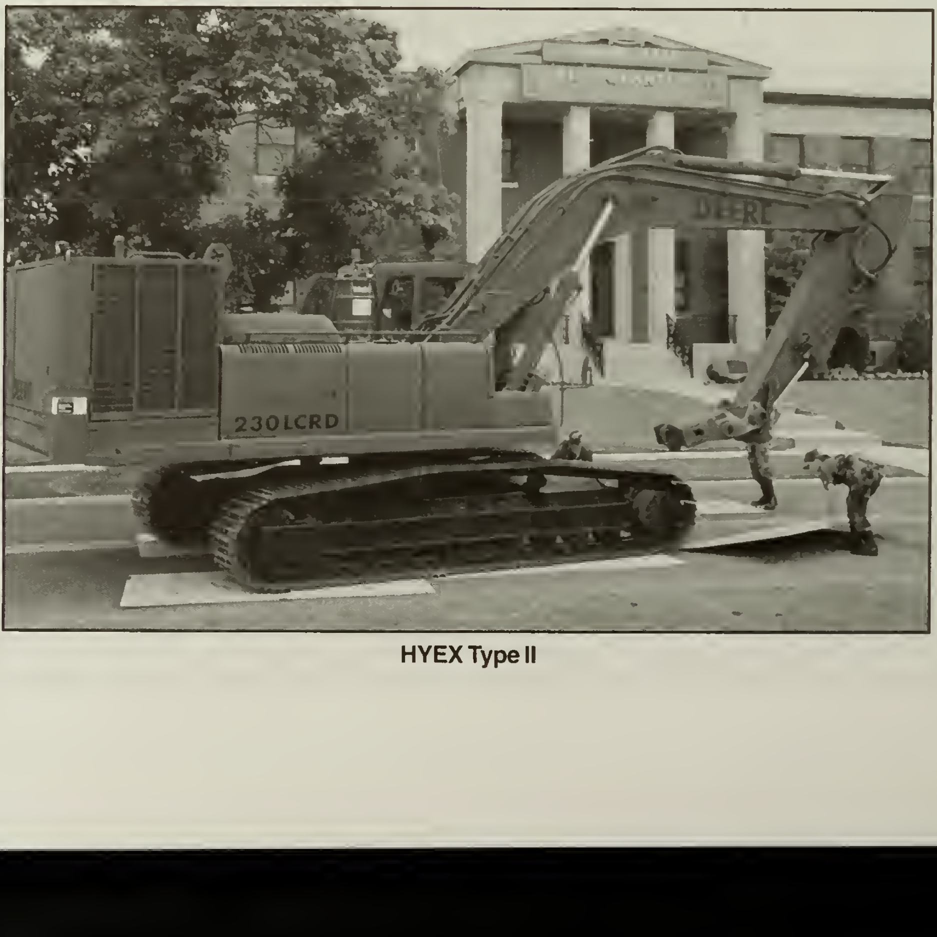
Although the HYEX is not new to public industry, it is new to the Army inventory. It represents a critical step in expanding and improving the unit's ability to train soldiers while meeting its peace and wartime missions. In addition, the heavy-duty equipment will enhance the unit's capability to support the Federal Emergency Management Agency and other humanitarian missions.

A versatile type of construction equipment, the excavators were specifically adapted for military use. During the next year, other engineering units will receive the HYEX. Because of their interchangeable extensions, the three types of excavators can cover every needed job for land construction from drilling, hammering, breaking, lifting, and filling in.

According to the commander of the 77th Regional Support Command, fielding this equipment at Fort Dix is a testament to the post and to the U.S. Army Reserve forces.

Ms. Nisbet is the public affairs officer at Fort Dix, the U.S. Army Reserve Command's largest training installation, and the editor of the Fort Dix Post.

The photograph was provided by members of the 358th Mobile Public Affairs Detachment, Salt Lake City, Utah.



HYEX Type II

The Wolverine: An Update

By Major J. Gary Hallinan

The Wolverine is back for fiscal year 2001. While the Army is transforming to become lighter and more transportable, support to the legacy maneuver force continues. The Product Manager Wolverine, Deputy for Systems Acquisition (DSA), U.S. Army Tank-automotive and Armaments Command (USATACOM), Warren, Michigan, will field 12 Wolverines to the 588th Engineer Battalion, 4th Infantry Division, Fort Hood, Texas, by January 2001—just in time to participate in the First Digitized Division Capstone Exercise at the National Training Center, Fort Irwin, California, in March 2001.

The fielding of the Wolverines is the direct result of several things: restored fiscal year 2000 funding for low-rate initial production (LRIP) increment three, a congressional plus up in fiscal year 2001 to procure 12 additional Wolverines on the current LRIP contract with General Dynamics Land Systems, and the Wolverines' successful demonstration during the Limited User Test conducted earlier this year. Now, maneuver-brigade commanders will have a true military load class (MLC) 70 gap-crossing capability up to 24 meters that can keep pace with and is as sustainable as its supported force.

Several milestones still must be met in order to complete the production and fielding of the remaining Wolverines. The system must go through an initial operational test and evaluation in late 2001 at Fort Hood. This test will formally evaluate the entire system—its qualitative reliability, availability, and maintainability as well as the soldiers who interact directly with the Wolverine. Pending successful completion of this test, the Wolverine program will be scrutinized during the Milestone III decision, which is scheduled for the second quarter of fiscal year 2002. The deciding authority (DSA, USATACOM) will base its decision on several criteria to determine if the program is ready to move on to the next phase of its life cycle—full-rate production.

It is clear why the Army decided to restore the Wolverine after its near termination from Program Budget Decision 745. The Wolverine, the Engineer Regiment's only digitized platform, has commonality with the current legacy force since it is based on an M1A2 System Enhancement Program (SEP) chassis that has been modified to transport, launch, and retrieve an MLC 70 Leguan bridge across gaps up to 24 meters wide. The Wolverine will provide the Army with responsive assault-bridging capability, enabling freedom of maneuver on the digitized battlefield. The Wolverine is a one-for-one replacement for the armored vehicle-launched bridge (AVLB). A significant improvement over the older existing technology, the Wolverine brings the following capabilities to Force XXI engineers:

- Improved force readiness.
- Improved force mobility. The Wolverine is as mobile and as agile as the supported maneuver force, a key requirement for flexibility of maneuver.
- Improved gap crossing. The Wolverine can cross 73 percent of gaps theater-wide, compared to the AVLB's 54 percent.
- Caution-free MLC 70 crossing at 24 meters.
- Reduced logistics footprint. The Wolverine's chassis is 90 percent compatible with the M1A2SEP.

The path forward is clear. Although the First Digitized Division Capstone Exercise is not a formal test of the system, the performance of the Wolverine and how it interacts as part of the heavy maneuver, digitized brigade is critical to the future of the program and the role the Engineer Regiment will play in the first Digitized Division.

Major Hallinan is the Wolverine Assistant Product Manager, U. S. Army TACOM, Warren, Michigan.

Wolverine

Engineers Train With New, Advanced Equipment

The lightweight mobile obstacle breacher will clear a path 250 feet long and 18 inches wide.

By Private First Class Matthew J. Jenkins

During the recent Digital Mountain Peak exercise at Fort Drum, New York, sappers from A Company, 41st Engineer Battalion, 10th Mountain Division, trained with new equipment designed to increase the survivability and agility of the division. The training was in preparation for the Joint Contingency Force Army Warfighting Experiment that the 10th Mountain Division participated in at the Joint Readiness Training Center, Fort Polk, Louisiana, from 9 to 21 September 2000. Combat engineers are an integral part of the combined-arms team, and this new equipment will allow brigade engineers (engineer company commanders) to respond quicker to the brigade task-force commander's intent on the battlefield.

Lightweight Mobile Obstacle Breacher

To clear a path through a suspected minefield more quickly, light engineers now can turn to the lightweight mobile obstacle breacher (LMOB). The 55-pound, manpackable device is designed to eliminate surface-laid or buried antipersonnel mines. The LMOB contains a 250-foot, rocket-propelled detonation cord; a 30-foot spool of wire that attaches to the detonator; and a stake that secures the case to the ground.

The detonation cord contains 1,000 grains of explosive substance per foot, which will clear a 250-foot-long, 18-inch-wide path through an antipersonnel minefield. This is 20 times stronger than the old 50-grain-per-foot detonation cord. Attached to the front end of the detonation cord are two twisted metal cables about 3 feet long. These lightweight cables, which are attached to both sides of the rocket base, allow the rocket to successfully deploy without tearing away from the detonation cord. The LMOB, which comes with two reloads per kit, eventually will be employed by infantrymen if sappers are not readily available.

Mini-Mine Detector

One of the new tools that will increase the survivability of light fighters is the mini-mine detector (MIMID), which is about half the weight and one-fourth the size of the older conventional mine detector (the AN/PSS-12). A soldier can comfortably crawl on the ground with this new device to elude enemy fire. The small, collapsible frame of the MIMID makes it ideal for light engineers or light fighters to have readily accessible. Unfolding up to 4 feet in length, the 6-pound MIMID is powered by four AA batteries that are located in the handle.

To use the MIMID, a soldier sticks one hand through a hollow, rectangular frame and grips a handle located directly behind the top of the electronics control unit (ECU). The top of the frame rests against the bottom of the wrist to provide stability. A soldier can probe a 1-meter area 180 degrees in front of him with the MIMID's hollow, rectangular search head.

The ECU is the brains of the MIMID. There is a light-emitting diode (LED) on top of the ECU and an earpiece connection on the right side. A pair of knobs at the bottom of the ECU allows an operator to control the volume of the earpiece and the sensitivity of the search head. The ECU of the older mine detector was separate from the probing device.

The LED allows light fighters to tell if they are "hot" or "cold" when it comes to mine detection. The flashing red, six-level meter goes from top to bottom to inform a soldier of the presence of a metallic object. Then a "probe man" determines if the metallic object is a mine. If it is, a demolition team comes along and destroys the mine.

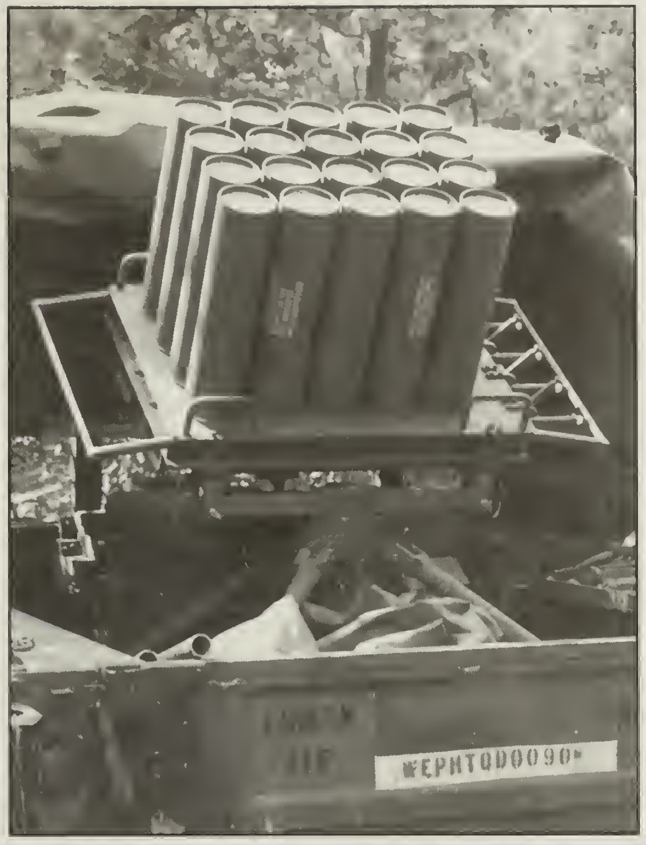
Volcano (Light)

In addition to new devices for defeating the enemy's land mines, light engineers are training with a new tool that will allow them to lay mines of their own. The Volcano (Light) is designed to lay a minefield about 900 feet long and more than 110 feet wide. Attached to the back of a high-mobility, multipurpose, wheeled vehicle (HMMWV), it allows more mobility than the larger Volcano, which is attached to a 5-ton truck.

The Volcano (Light), which is operated from where the back seat would normally be in a HMMWV, sits about 18 inches off the vehicle's floorboard on a stand that rotates 180 degrees. The Volcano (Light) has twenty 2-foot-long metal canisters, each containing five antitank mines and one antipersonnel mine. The canisters are braced by an inclined strip of metal. Once the canisters are armed, pressing a button expels the mines over the perimeter. When the mines hit the ground, trip wires spring out of each mine to prevent the enemy from passing safely.

M-Gator

Conserving soldiers' energy on today's up-tempo battlefield is always an issue, and a new device unveiled during Digital Mountain Peak helps conserve that energy. The newly modeled M-Gator is basically a military golf cart. It's a six-wheeled, topless vehicle that is able to travel through all types of terrain. About 3 feet tall, it is much more mobile than a HMMWV. The two-seated vehicle can haul up to 1,400 pounds of equipment in two cargo trays. The smaller equipment tray on the hood holds about 2 cubic feet in volume, and the rear tray holds about 14 cubic feet. The 18-horsepower M-Gator, which runs on diesel fuel and can reach a speed of 17 miles per hour, can be sling-loaded by a UH-60 Black Hawk helicopter. The M-Gator can be used for ev-acuating casualties, laying communication lines, and transporting messages.



The Volcano (Light), scaled down to fit a HMMWV to match the mobility of a light fighter, creates a defensive minefield.

Skid Steer

In addition to helping clear obstacles, a new initiative—the skid steer—will also help light engineers construct some obstacles and field fortifications of their own (see *Engineer*, February 1998, page 18). The highly maneuverable skid steer, which resembles the combination of a small bulldozer and a small forklift, increases combat-engineer-squad capabilities and reduces physical fatigue. Two versions of the skid steer—both camouflage-painted and commercially available—are being evaluated. The Melroe Bobcat® Model 763 (see front cover) is a rubber-tired vehicle but, when needed, steel tracks can be manually installed over the tires to increase mobility. The Caterpillar® ASV Model MD-2810 has full-time rubber tracks for propulsion, which gives a reduced psi rating for traveling over wet and swampy terrain. Seven different attachments can be installed on either skid steer:

- Picket pounder—installs concertina wire, pickets, and post.
- Clamshell bucket—excavates or drops material in a designated spot. It is used for paving projects, such as filling in potholes.
- Auger (12-, 24- or 36-inch)—drills holes. One practical use for the 24- and 36-inch augers is to drill side-by-side holes up to 5 feet deep.
- Backhoe—excavates sand or gravel.
- Pavement breaker—breaks down pavement, concrete, or asphalt obstacles.
- Closed bucket—transports excavated materials.
- Fork lift—moves palletized equipment.

High-Mobility Engineer Excavator

The new high-mobility engineer excavator (HMEE) will phase out the older small emplacement excavator (SEE). The HMEE will provide better mobility, greater reliability, and a larger front-end loader than the SEE. The HMEE can reach a speed of 70 mph, as opposed to the SEE's top speed of 30 mph. The HMEE's front-end loader can be used for limited bulldozing. A backhoe attachment can excavate up to 14 cubic feet of dirt or gravel per scoop, 7 cubic feet more than the SEE. When the backhoe is not in use, it folds up, turns sideways, and leans in toward the HMEE's cab. The HMEE will be helpful to all soldiers on the battlefield, whether they need to dig a fighting position in a few seconds or construct a large berm to serve as a barrier from the enemy.

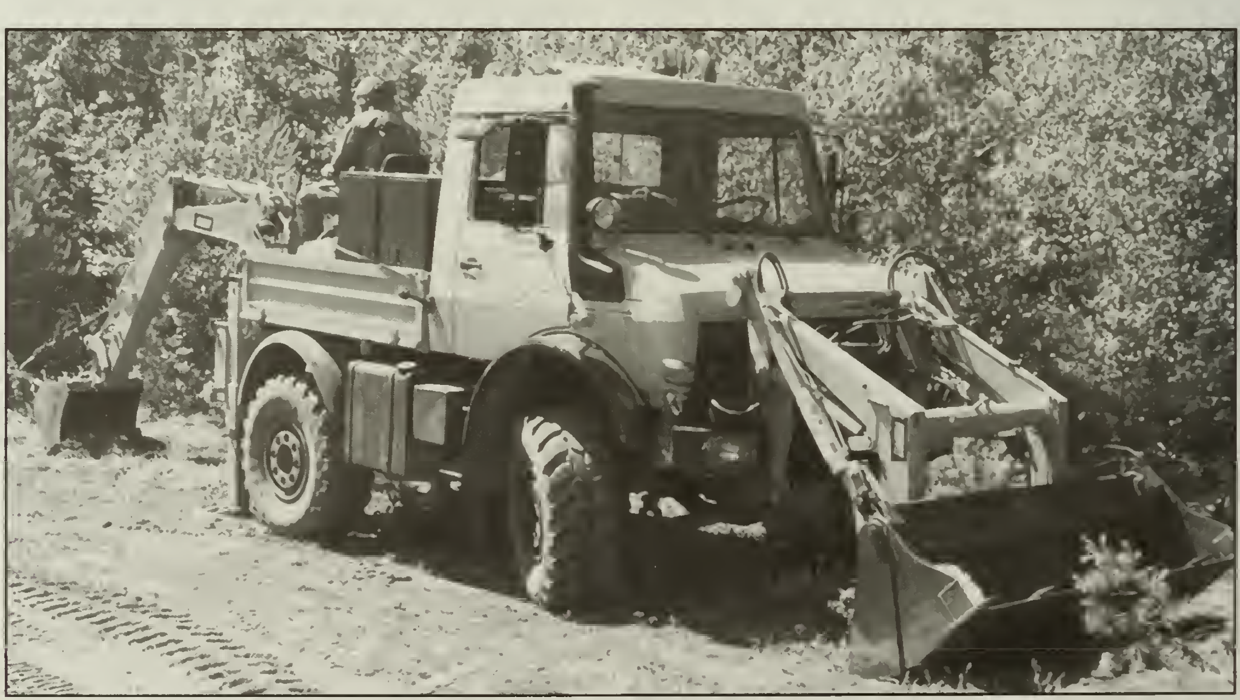
Robotic T-3 Dozer

Light engineers also will be using some new technological initiatives to tackle obstacles during military operations in urban terrain (MOUT). They can stay out of harm's way while clearing obstacles, thanks to the new Robotic T-3 Dozer, which is designed to clear away rubble and debris that obstructs the path of light fighters in MOUT settings. The diesel-fuel-operated dozer is about 12 feet long and 9 feet tall. Propelled by steel tracks, it weighs between 4 and 5 tons and has a top speed of about 10 mph. The remotely controlled bulldozer can be operated from up to 1,000 feet away. A camera placed on the ceiling of the dozer's cab projects onto a television screen and allows the operator to see as if he were sitting in the cab.

Urban Robot

Light engineers also trained with a new robotic reconnaissance tool that is small enough to recon sewers and tunnels in a MOUT setting. The urban robot (URBOT)—which has a camera on its front, rear, and top—can be operated from up to 1,000 feet away. A lithium battery powers the unit for up to 2 hours.

The black aluminum URBOT is a 65-pound, manpackable initiative that is about 2 feet long and 1 foot wide. It is rubber-tracked, can travel about 3 feet per second, and can climb stairs. The URBOT is a unique two-way reconnaissance device: the operator can speak through the device and also hear sounds. The URBOT can be guided to approach a person, shine a light



The HMEE is faster and more reliable and will do double the work of the SEE.

in his face, and speak directly to him to identify him as friend or foe. Another use the 41st Engineer Battalion found for the URBOT was to guide it under a HMMWV to find an oil leak with the robot's lighted camera.

Topographic Systems

In addition to those forms of reconnaissance, light engineers can also provide topographic maps to brigade task-force commanders. A three-part system for collecting topographic information will allow terrain detachments to disseminate information much faster. The system collects data from satellites orbiting the earth, sends it to a compact disc, prints it, and puts it into squad leaders' hands.

The first new initiative accessed in this chain of events is the Rapid Terrain Data Generation (RTDG) System. This set of compact discs contains data collected from aerial reconnaissance devices. Satellite dishes that orbit the earth and airplanes feed the computer data about terrain features. The technology on the compact disks turns the data into a high-resolution topographic map.

After the data is sent from the RTDG System, it hits the second new initiative on this information highway, the Digital Topographic Support System-Light (DTSS-L). The DTSS-L is mounted inside a shelter on the back of a HMMWV. In addition to the regular devices of a HMMWV, the DTSS-L has some commercial-off-the-shelf (COTS) technology—such as printers, scanners, and a computer workstation—to help topographers process the geographic data. Through a computer network link, the information goes to a third new initiative, the Rapid Hardcopy Reproduction (RHR) System. The RHR System has the capability to print up to 5,000 color maps a day. Because they are connected by a computer network, RHR Systems can be set up in many places on the battlefield. This will allow information to be distributed to a large group of people in a small amount of time. The brigade's tactical-operations center will be able to disseminate the topographic information all the way down to the squad leaders.

Conclusion

The 41st Engineer Battalion wants to build on these emerging technologies to increase the unit's versatility and mobility on the modern battlefield. With this new equipment, the battalion will be better prepared to maximize combat-engineer support to the division across a full spectrum of operations.

(All photographs by Private First Class Matthew J. Jenkins.)

Private First Class Jenkins, a staff writer for the Fort Drum Blizzard, is a graduate of the Department of Defense Information School's Basic Journalism Course 6-99, Fort Meade, Maryland.

The Engineer Writer's Guide

We think engineers take a special pride in their profession, and *Engineer* is always looking for articles from readers who want to share their expertise, experience, and ideas.

If you are a potential contributing writer, here are a few "writer's guide" tips to steer you in the right direction.

Articles may discuss engineer training, operations, doctrine, equipment, history, or other areas of general interest to an engineer readership.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers, that's what we need.

Articles should generally come from contributors with firsthand experience of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words, and text should be double-spaced. Generally, each such page should contain from 200 to 250 words. Manuscripts should be originals or clear copies. Provide a 3 1/2-inch disk in Microsoft Word, Rich Text Format, or ASCII (please indicate word-processing format on disk or cover letter). You also may send articles by e-mail to *bridgess@wood.army.mil.*

Articles containing attributable information or quotations not referenced in the story should carry appropriate endnotes.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint.

Include your full name, rank, current unit, and job title. Also include a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime phone number.

Reviews of books on engineer topics are also welcome.

Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 Engineer Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

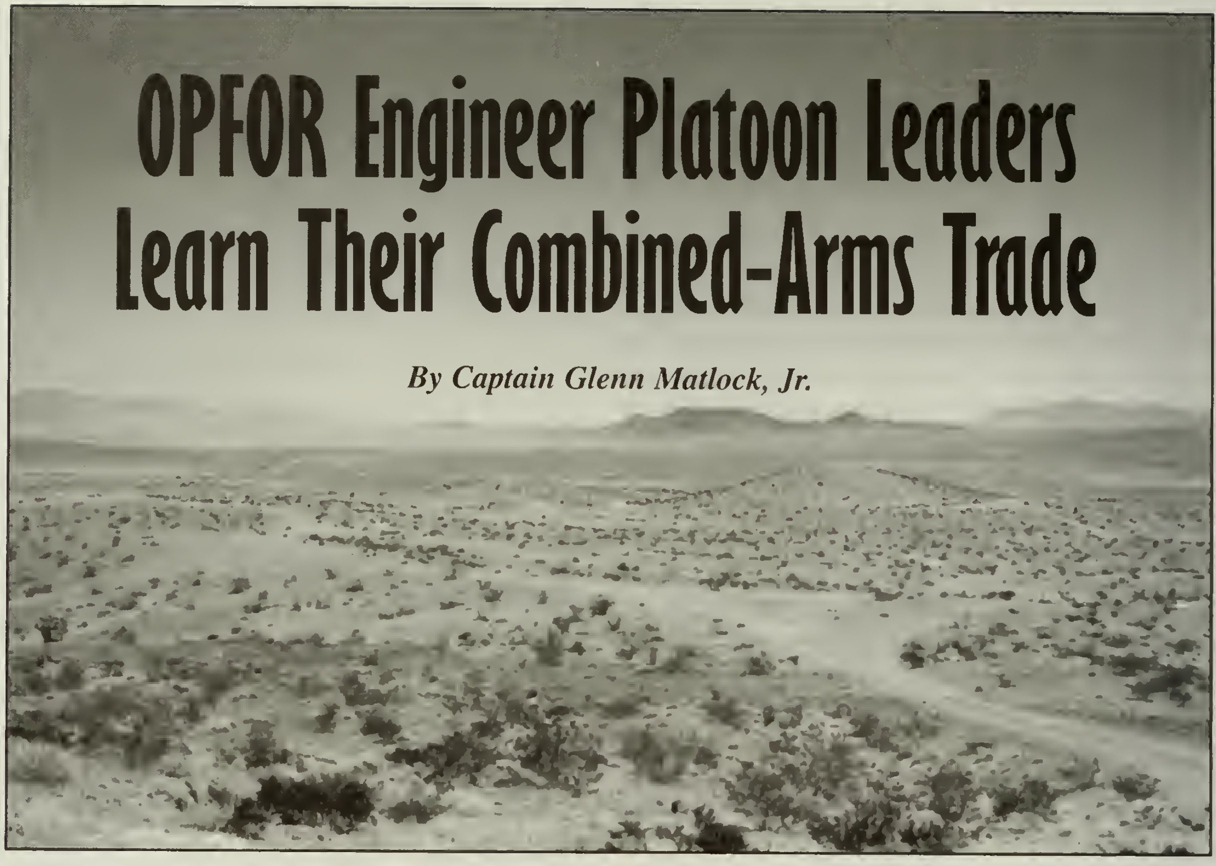
All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges, at DSN 676-5266, or commercial (573) 596-0131 ext. 35266. We look forward to hearing from you.

Note: Due to the limited space per issue, we will not print articles that have been accepted for publication by other Army professional bulletins.

OPFOR Engineer Platoon Leaders Learn Their Combined-Arms Trade

By Captain Glenn Matlock, Jr.



By and large, junior officers who serve as combat supporters with the opposing force (OPFOR) at the National Training Center (NTC) at Fort Irwin, California, develop a firmer grasp of combined-arms operations than their peers who serve in different branches and/or duty locations. Engineer platoon leaders serving with the 58th Combat Engineer Company (CEC)—the separate company that supports the 11th Armored Cavalry Regiment (ACR) in its OPFOR mission at the NTC—learn and master their trade as combined-arms combat supporters. They practice multiechelon leadership, hone their skills as staff advisors, develop a higher degree of situational awareness, and repeatedly plan and conduct a combined-arms operation. Then, they put all the pieces of the combined-arms operation together in a large-scale-conflict scenario.

Serving in Multiechelon Leadership Positions

The learning curve for junior officers in the OPFOR is steep because they typically serve in positions that represent units one to two levels higher than their actual unit. For example, a platoon replicates a company and a company replicates a battalion. As such, the leadership also must rise to the occasion of the troop-leading duties that the replicated unit requires. Put simply, a platoon leader in garrison becomes a company commander on the battlefield.

When the 11th ACR takes on the role of the OPFOR, it fuses two maneuver squadrons together to replicate a motorized rifle regiment (MRR), consisting of four motorized rifle battalions (MRBs) and each implied headquarters element. In support of the OPFOR mission, the 58th CEC coordinates the efforts of a visiting engineer company with its internal capabilities to replicate the 46th Krasnovian Engineer Battalion.

To simplify the process of supporting the OPFOR in each of its dynamic missions on the NTC battlefield, the 58th CEC incorporates the duties of the three line platoon leaders into components of the OPFOR campaign. One platoon leader is responsible for coordinating the company's support for offensive operations, such as meeting battles, MRR penetration missions, counterattacks, raids, and decoy missions. Another platoon leader coordinates the company's support to defensive operations, including deliberate and hasty defenses, covering-zone operations, and security-zone operations. The third platoon leader either augments the executive officer as the operations officer in the field or manages sustainment projects tasked to the company. The assault-and-obstacle platoon leader advises maneuver commanders on all survivability operations.

In defensive operations, such as MRB deliberate defenses or MRR security-zone defenses, the platoon leader responsible for defensive support coordinates not only the efforts of his platoon but also those of the other platoons in the company and an additional company of augmentee engineers. In terms of execution, the defensive platoon is responsible for the entire defensive operation, a planning and supervising task usually tackled by a company or battalion. Likewise, the offensive platoon leader is responsible for all engineer support to the MRR in offensive operations, usually a task for an engineer company or battalion commander.

Engineer platoon leaders have the opportunity to staff and plan the operation that they will support, develop the accompanying engineer overlays and estimates, and then execute and supervise that operation. Platoon leaders can observe their overlay becoming not just a complex obstacle belt but a full-blown engagement area. Their level of involvement stretches through the entire defensive operation as they overwatch the critical areas in the obstacle belts—supervising the execution of situational obstacles, reporting the enemy's positions and activities while conducting breaching operations, and calling for fire. Not only do the platoon leaders experience the magnitude of providing engineer support to a regiment-sized unit, but they also witness the effects of their mission on the higher unit's mission and on the enemy.

Serving As Unit Leaders and Staff Officers

Combat supporters who are with the OPFOR wear dual hats, serving both as their respective unit leader and as the regimental staff officer. In the OPFOR, there are no staff officers who are equivalent to assistant brigade engineers to serve as the link between the regimental staff and the 58th CEC. Instead, the platoon leader who supports offensive or defensive operations is the engineer advisor to the staff and commander. These platoon leaders, with varied assistance from the executive officer, attend the planning sessions for the war games, orders, and rehearsals that are pertinent to either the offensive or defensive operation.

Regimental and squadron staff officers and commanders depend on engineer platoon leaders to be experts in the mobility/countermobility/survivability Battlefield Operating System (BOS). Engineer lieutenants must be masters of their field craft because the success of the NTC operation depends on it. For example, the platoon leaders who support defensive operations advise MRB commanders on engagement-area development, situational-obstacle use, and engineer blade assets for all the defensive missions for a given rotation.

An OPFOR engineer helps his squad create a breach lane.

There are usually five battle scenarios for the force-on-force portion of the rotation, with at least two or three of them being defensive missions for the OPFOR. Therefore, the defensive platoon leader must coordinate with three separate MRB commanders to plan engagement-area development for each rotational scenario. Planning must include analysis of the enemy's possible courses of action, deception, flank security, mobility of the combined-arms reserve, and the location of fighting positions and obstacle belts in relation to system capabilities of both forces and terrain. In short, the engineer platoon leader must craft an engagement area that optimizes engineer assets and time, maximizes the use of terrain, protects friendly combat forces, and fully supports the MRB commander's intent and scheme of maneuver. These tasks normally are performed by an engineer-battalion staff or by an engineer-company commander. Platoon leaders in the 58th CEC perform the tasks with minimal supervision, in addition to performing their platoon-leader duties. As a result, junior lieutenants practice the higher-level planning and staffing process, which provides them exposure to the combined-arms planning process.

Learning Through Repetition

Junior officers who serve with the OPFOR practice combined-arms operations several times per month every month. At the NTC, there is always a next time. Leaders can take away lessons and apply what they have learned repeatedly throughout their tenure of leadership. Furthermore, since the OPFOR must be a freethinking opponent, the scheme of engineer operations must constantly adapt to the capabilities of the visiting brigade combat team, the regimental commander's intent, and the past lessons learned. Thus, combat-engineer platoon leaders can apply both the positives and negatives of lessons learned for the same type of operations (for example, security-zone defense) and apply them as they plan, staff, and execute engineer operations for future battles. As a former commander of the 58th CEC said, "You have a rare opportunity to make a plan and then see the execution of that plan."

The success or failure of the regiment provides instant feedback on the junior officers' decisions and actions before and during an operation. Unlike many of their maneuver companions, platoon leaders from the 58th CEC attend the regimental after-action reviews ("hot washes"). There they receive instant feedback not only on their unit's success or failure but also on how it affected the success or failure of the OPFOR.

Developing Situational Awareness

In general, combat supporters develop a high degree of situational awareness because they typically support echelons two and three levels higher than their own. Unlike their maneuver and engineer counterparts at other duty stations, OPFOR engineer platoon leaders must attend war games, staff synchronization drills, regimental operations orders, back briefs, and regimental rehearsals. Thus, they develop an understanding of the mission as a regimental operation as opposed to a sub-unit-level operation.

The mission itself requires that the platoon leaders operate at a higher level of situational awareness, because they must synchronize the transition of assets from unit to unit—sometimes several times in one operation. Although they may be task-organized to one MRB at the onset of a mission, they are regimental assets and must act to accomplish the regimental mission. For example, platoon leaders must anticipate encountering situational obstacles throughout the depth of the battlefield simultaneously and must advise the maneuver commander on how to employ engineer assets both before and during the mission.

The task organization of engineers changes from mission to mission in an offensive campaign with the OPFOR. Engineer platoon leaders play a crucial role in determining that task organization because they are ultimately the ones who advise the regimental staff and commander on how to best employ engineer capabilities based on intent, terrain, and enemy capabilities. The typical task organization of engineers during an offensive operation is to attach a mobility support detachment (MSD) with the forward security element and a mobile obstacle detachment (MOD) and a Volcano (UMZ) with the advanced guard main body; then, an MSD and an MOD travel with the main body. However, depending on a rotational brigade's propensity to use and proficiency in using situational obstacles, both MSDs may be "front-loaded" with the advanced guard. Likewise, the UMZ and the MODs may be task-organized as an independent situational-obstacle detachment traveling with the antitank battalion to seal assailable flanks autonomously of the main maneuver effort's ability to develop the situation. The engineer platoon leader, under the coaching of the 58th CEC commander, makes these determinations and recommendations in the planning processes that go into each mission.

"The vast training area of the NTC and the dynamic desert terrain give engineer platoon leaders the opportunity to develop a varied expertise in operations."

Engineers also learn about the other BOSs and how they all fit together. As a matter of routine, engineer platoon leaders advise peers in maneuver squadrons on employing internal and external assets to conduct an operation effectively—whether it is during an STX or a rotational scenario. Sometimes, an engineer may actually advise a peer on how to integrate all attached combat-support elements into the scheme of maneuver, or even shape the peer's scheme of maneuver. The reason engineers can do this is because they have more experience with the combined-arms concept and how each BOS fits in the picture. Integrating internal operations into a combined-arms team is essential to understanding the concept, and practicing that integration is the key to mastering it. OPFOR engineer platoon leaders practice this every month.

Putting It All Together

Officers at the NTC have the opportunity to participate in large-scale execution of exercises, putting together all the elements of maneuver and combined-arms operations. Leaders can practice their skills through train ups, rehearsals, and STXs. However, there is no substitute for putting all the pieces together. Every exercise within the OPFOR regiment is always a combined-arms operation.

Additionally, junior leaders and soldiers have the opportunity to focus on their specific tasks—whether it is emplacement of obstacles or maneuver support—because the higher-echelon leaders are very efficient in planning and coordination, which enables routine execution. The normal difficulties that hinder training in most units, such as availability of maneuver areas and training dollars, do not play a major role in shaping training for the OPFOR. While it places an unreasonable limitation on home-station training, ranges, and demolition qualification tables, the 58th CEC has the opportunity to conduct multiechelon maneuver and operations—be it in either the rotational scenario or in rotational train-up STXs. Thus, platoon leaders have the luxury of conducting essential engineer cornerstone missions and doing so at an incredibly high operational tempo.

The vast training area of the NTC and the dynamic desert terrain give engineer platoon leaders the opportunity to develop a varied expertise in operations. The NTC rotation is the end-all training event for which most other units train. It is the opportunity to put an operation together against a large force in a large training area. For the OPFOR, it occurs every month. The dynamics of supporting several headquarters and units simultaneously is a matter of routine for engineer platoon leaders who serve in the OPFOR. This allows junior officers to develop skills necessary to effectively advise and support units in multilevel operations.

The multiechelon operations encompassed in each rotational scenario

(continued on page 30)

The Corps of Engineers

By Dr. Larry Roberts

On 16 June 1775, the Continental Congress resolved "That there be one Chief Engineer at the Grand Army.... That two assistants be employed under him ...." This marked the beginning of the Corps of Engineers. In the following year, a number of individuals were given appointments as engineers or assistant engineers in the Continental Army. Three years later, the Congress authorized the recruitment of three companies of engineers, generally referred to as miners and sappers. The organization of these companies—and the officers having engineer responsibilities—into a "Corps of Engineers" came on 11 March 1779. During the Revolution, these miners and sappers worked on field fortifications and roads. At the Battle of Yorktown, they joined in the assault of Redoubt No. 10 in their secondary capacity as infantrymen. At the close of the Revolution, the Corps was mustered out of service.

Because of a recognized need for a regular military establishment, Congress took a number of steps in the early 1790s to reconstitute the American Army. One of these was the establishment of the Corps of Artillerists and Engineers in 1794. During the crisis with France four years later, an additional regiment of artillerists and engineers was formed. However, it was soon recognized that the duties and functions of the artillerists and engineers, while connected, were distinct. In 1800, a movement began to separate the two branches. On 16 March 1802, Congress authorized President Thomas Jefferson to establish a separate Corps of Engineers. The law also stated "That the said corps when so organized shall be stationed at West Point, in the State of New York, and shall constitute a military academy ...." By this action, the Congress recognized that military engineering was a science and therefore required formal education and training.

Initially, the Corps consisted primarily of officers and cadets. However, in 1803, the commanding officer of the Corps was authorized to enlist 18 men and 1 artificer to help conduct experiments at West Point and for other purposes. This constituted the first enlisted personnel in the Corps since its separation from the artillery several months before. During the War of 1812, a company of bombardiers, sappers, and miners served on the Northwest Frontiers. For the next 40 years, the Corps's responsibilities centered around the construction of coastal fortifications and the exploration of the American West.

In 1838, Congress authorized the creation of a separate Corps of Topographical Engineers. Individual topographical engineers had been serving under the Chief of Engineers since 1816, and the topographical-engineering mission dated from the appointment of Mr. Robert Erskine to be geographer and surveyor of the roads. Much of the effort on the nation's internal development, such as roads and waterways, was done by the "topogs."

During the Mexican War, engineer and topographical-engineer officers performed valuable services to the nation. Captain Robert E. Lee, Corps of Engineers, received several brevets for heroism and gallantry as General Winfield Scott's staff engineer. Significantly, Congress authorized the creation of a company of miners, sappers, and pontoneers for the Regular Army. Interestingly, these enlisted men were to be called engineer soldiers. Before this, the term engineer had generally been confined to officers. Following the Mexican War, the engineers returned to their civil works, fortifications, and exploration projects. In the 1850s, engineers surveyed several routes for the proposed transcontinental railroad.

In the first days of the American Civil War, Congress added three additional companies of engineers and one of topographical engineers. Formed into a battalion of engineers, they worked on field fortifications, conducted terrain reconnaissance, and built numerous fixed and floating bridges (see article, page 42). In 1864, the battalion built a floating bridge over the James River that exceeded 2,000 feet in length—a record that stood until 1945. The efforts of the regular battalion of engineers were supported by numerous volunteer engineer regiments, such as the 15th and 50th New York Volunteer Engineer Regiments.

Following the Civil War, the Corps returned to its peacetime missions. All of the work of the Topographical Engineers went to the Corps when the topogs merged with the Corps in 1863. Waterways, coastal fortifications, and lighthouses were the most important peacetime responsibilities. The structure of the Corps remained relatively constant until 1901, when the companies were enlarged and reorganized into three battalions of regular engineers. The Corps's experience with waterways was of great value when the Panama Canal Commission appointed engineer officers to direct the construction of the canal (see *Engineer*, February 2000, page 28).

In the years immediately preceding our entry into World War I, the Army and the Corps underwent expansion and reorganization. The Army adopted the divisional system, which constituted the combined-arms structure used today. Key to this was the creation of divisional engineer regiments that numbered almost 1,500 officers and men. When the country entered the war, additional engineer regiments appeared. Many of these worked on specific missions, such as railway construction, forestry, and harbor development.

The Corps's record of accomplishment during World War I established the general pattern of engineer operations during World War II. General service and combat regiments built every conceivable structure or facility in the various theaters of operation. Combat regiments and battalions supported the maneuver forces with roads, bridges, and mine warfare. At home, the Corps supervised the $15.2 billion defense-construction program. Included was the $2 billion Manhattan Project, which began the era of atomic warfare.

The end of the war against the Axis powers ushered in the Cold War between the free world and the communist states. The Corps responded with an intensive program of military construction that consisted of distant early-warning sites, military bases overseas, and missile installations. The Cold War turned hot in Korea between 1950 and 1954 and in Southeast Asia a decade later. For both of these conflicts, engineers not only fought alongside maneuver forces but also constructed countless support facilities. In the seesaw battles in Korea, combat engineers demolished, rebuilt, and destroyed the same bridges as the tide of war moved across the Korean landscape. Vietnam posed an even greater problem due to the nature of that insurgent conflict and the lack of support facilities for troops in the field. Firebases, airfields, heliports, harbor facilities, and major highways were among the tasks of builders and fighters. All of this occurred while the civil works side of the Corps continued with navigation, flood-control, hydroelectric, and military-construction projects in the United States.

The end of the Cold War did not bring the dividends of peace that so many Americans desired. Contingency operations in Granada, Panama, and Kuwait brought combat engineers into action. Humanitarian efforts such as Provide Comfort and Restore Hope constituted yet another mission for the Corps. Rebuilding Kuwait, providing for relief of displaced refugees, and supporting United Nations efforts in Somalia and the Balkans called for both combat and construction skills. Disaster assistance for victims of hurricanes, floods, and earthquakes continues to be a peacetime challenge of the Corps.

For more than 200 years, miners, sappers, pontoneers, and topogs-engineers have contributed to the development of this nation and of developing nations. In war, engineers have been fighters and builders of those things needed to sustain the battle. If the past is simply a prologue of the future, engineers must continue to hone their ability to build and, if necessary, to fight.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

Photo by C.J. Allen

Colonel Brian E. Osterndorf, commander of the Corps of Engineers' New England District, salutes Colonel Richard Gridley, the first Chief Engineer, during a wreath-laying ceremony at the Canton Corner Cemetery, Canton, Massachusetts, to mark the Corps's 225th birthday. The New England District's Ranger Color Guard accompanied Colonel Osterndorf to Colonel Gridley's grave site.

(continued from page 28)

provide junior officers with an end-state result in mind for each given mission. Platoon leaders know how they fit into the big picture and how the big picture fits into their training and performance.

Conclusion

While no one could win the argument that engineer platoon leaders at the NTC receive better overall training than their counterparts, it goes without saying that they develop and master the concept of their combined-arms role on the battlefield. The reason is simple: They do it the right way, all the way, all the time, every time. The Army depends on combat supporters to know and master their trade. When questioned about the use of engineers in the complex Force XXI Army during a visit he made to the NTC, Major General George Harmeyer (former commander of the Armor School) replied to the 58th CEC commander that "the onus would be on the maneuver commander to know how to use you."

The truth is that only knowledgeable and aggressive combat-support officers are going to get their assets integrated properly into the combined-arms fight. Those who have served with the 58th CEC have had a good taste of that concept. Lieutenants should seek out this assignment if they want to really learn their profession.

Captain Matlock, who is currently at Fort Carson, Colorado, spent three years at the National Training Center. A graduate of the U.S. Military Academy, he holds a master's in engineering management from the University of Missouri-Rolla. CPT Matlock recently completed the Engineer Captain's Career Course and the CAS3 Course.

Reference:

Law, Leonard J. and Ferdon, Keith R. "Red Devils! The 58th Combat Engineer Company." *Engineer,* November 1999, pp. 28-33.

Chiefs of Engineers

COL Richard Gridley	07 June 1775 - 05 April 1776
COL Rufus Putnam	05 April 1776 - 01 December 1776
MG L.L. Duportail	22 July 1777 - 10 October 1783
LTC Stephen Rochefontaine	26 February 1795 - 07 May 1798
LTC Henry Burbeck	07 May 1798 - 01 April 1802
COL Jonathan Williams	01 April 1802 - 20 June 1803
	19 April 1805 - 31 July 1812
COL J.G. Swift	31 July 1812 - 12 November 1818
COL W.K. Armistead	12 November 1818 - 01 June 1821
COL Alexander Macomb	01 June 1821 - 24 May 1828
COL Charles Gratiot	24 May 1828 - 06 December 1838
BG J.G. Totten	07 December 1838 - 22 April 1864
BG Richard Delafield	22 April 1864 - 08 August 1866
BG A.A. Humphreys	08 August 1866 - 30 June 1879
BG H.G. Wright	30 June 1879 - 06 March 1884
BG John Newton	06 March 1884 - 27 August 1886
BG J.C. Duane	11 October 1886 - 30 June 1888
BG T.L. Casey	06 July 1888 - 10 May 1895
LTG Raymond A. Wheeler	04 October 1945 - 28 February 1949
LTG Lewis A. Pick	01 March 1949 - 26 January 1953
LTG Samuel D. Sturgis Jr.	17 March 1953 - 30 September 1956
LTG Emerson C. Itschner	01 October 1956 - 27 March 1961
LTG Walter K. Wilson Jr.	19 May 1961 - 30 June 1965
LTG William F. Cassidy	01 July 1965 - 31 July 1969
LTG Frederick J. Clarke	01 August 1969 - 31 July 1973
LTG William C. Gribble Jr.	01 August 1973 - 30 June 1976
LTG John W. Morris	01 July 1976 - 30 September 1980
LTG Joseph K. Bratton	01 October 1980 - 14 September 1984
LTG Elvin R. Heiberg III	14 September 1984 - 05 May 1988
LTG Henry J. Hatch	17 June 1988 - 04 June 1992
LTG Arthur E. Williams	24 August 1992 - 30 June 1996
LTG Joe N. Ballard	01 October 1996 - 2 August 2000
LTG Robert B. Flowers	23 October 2000 - Present

Screaming Eagles Bridge the Gap

By Captain James Handura

Special-operations forces from Cortina destroyed the last remaining bridge over the Mississippi River. Their timing could not have been better, because they successfully stalled the joint task force's most critical logistics push of the operation. This bridge was a vital link in Main Supply Route Ford's ability to pass traffic. The nearest ribbon-bridge assets were almost 100 kilometers to the south. The joint-task-force commander knew there was only one unit that could move bridging equipment that far, over that terrain, that quickly. The 101st Airborne Division (Air Assault), known as the "Screaming Eagles," was called on to help bridge the gap until a more permanent bridge could be constructed.

This was the scenario under which C/7-101 Aviation Regiment (CH-47), 159th Aviation Brigade, 101st Airborne Division, Fort Campbell, Kentucky, and the 814th Engineer Company (Assault Float Ribbon Bridge), Fort Polk, Louisiana, recently conducted training. The genesis of this training event was derived from a corps-level simulation exercise in which the 101st Airborne Division had a "be-prepared" mission for just such a contingency. The training took place from 31 January to 4 February 2000, along the "old-river" portion of the Mississippi, with the help of the New Orleans District of the U.S. Army Corps of Engineers (see map, page 33).

Soldiers from the 814th Engineer Company prepare to hook a ramp bay.

The Training

The stated training objectives were to train aircrews and engineers to sling load ribbon-bridge equipment and to construct a ribbon-bridge raft properly.

Day One

The 814th Engineer Company commander and the C/7-101 flight-operations officer held a meeting to discuss the location and layout of the pickup and landing zones, bridge components and characteristics, load-hook-up training, aircraft familiarization, daytime and nighttime pickup- and landing-zone operations, load inspections, proper rigging techniques, the situational training exercise (STX) and, most importantly, safety.

Day Two

Hooker training—the required process of maintaining proficiency in the perishable skill of hooking rigged loads to a hovering rotary-wing aircraft—was conducted. In the 101st Airborne Division, soldiers must have actually hooked a load under an aircraft within the past 90 days to be qualified, unless they are recent Air Assault School graduates. One CH-47D Chinook landed at the pickup zone at 1300 hours, where it was greeted by an enthusiastic crew and the unique pieces of equipment from the 814th Engineer Company—an interior bay, a ramp bay, and a bridge-erection boat. The Chinook company commander conducted a class with the engineers on aircraft characteristics, aircraft safety, and actions of the hooker teams working underneath the aircraft. The daytime hooker training began at 1400 hours. Both bridge platoons had already rigged and positioned loads of all three types of equipment in the pickup zone and had rotated their personnel through the actual hooking of the loads under the aircraft. Many of the soldiers had never encountered the tremendous power and lift capability of the Chinook nor experienced its accompanying gale-force rotor wash.

When this training was completed, the Chinook picked up each load to verify the rigging, or the "link count," and then delivered it to the landing zone, which in this case was the Mississippi River. Nighttime hooker training began shortly after sundown, with the aircrews hooking the loads while wearing night-vision goggles (NVGs).

Day Three

This training consisted of slinging the bridge components and constructing a six-bay raft. The daytime portion began early, with both platoons rigging and positioning components of a six-bay raft along with one bridge-erection boat on the pickup zone. The plan was to sling bridge bays to the river (the landing zone), where the awaiting bridge crews in bridge-erection boats would assemble the sections into a six-bay-raft configuration. This raft is capable of transporting the heaviest vehicle in the 101st Airborne Division's inventory.

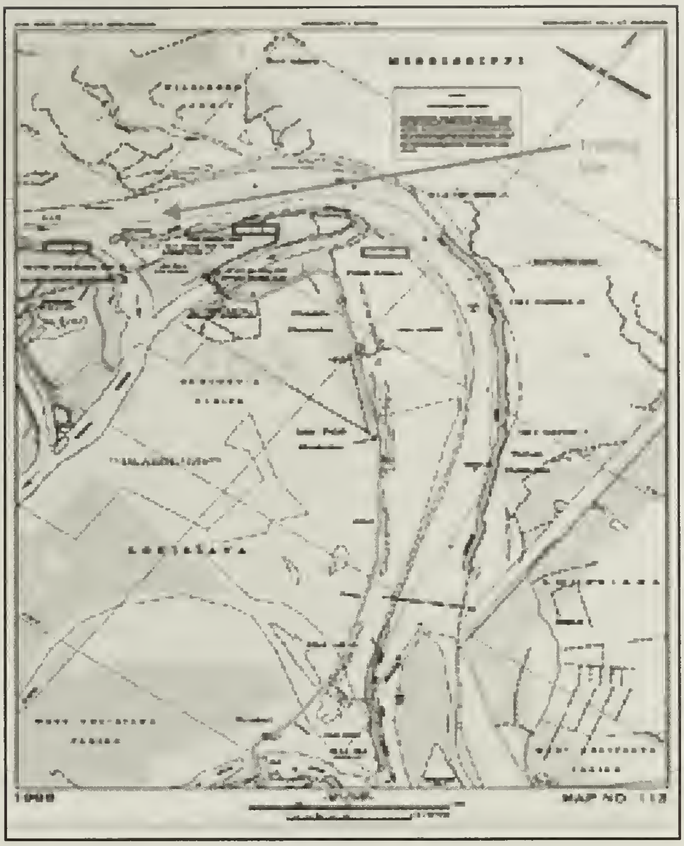
While engineers prepared the loads, the flight crews practiced their hovering position over the river and rehearsed ingress and egress from the pickup and landing zones. When rehearsals were completed, the individual training events were meshed and the collective training began. During this phase, the bridge crewmen assembling the rafts learned a valuable lesson: They must ensure that the sling legs were clear of the bay hinge points before the sections were unfolded or the section would remain in the folded position.

Once again, the nighttime training followed the same sequence as the daytime training, with the aircrews wearing NVGs. Aircrews are required to remain current and qualified while wearing NVGs, which is a challenging task. But flying with NVGs over water is even more challenging, especially when the landing zone must be shared with river barges that occasionally pass through the area.

The Exercise

The training event culminated with an STX, which began at 1100 hours. The flight-operations officer conducted the air-mission briefing, which included the overall enemy and friendly situation and the aircrew's role in the operation. After receiving the order, leaders finalized plans and conducted troop-leading procedures.

The STX focused solely on Phase II (Assault Across the River) of a deliberate river-crossing operation. According to Field Manual 90-13, *River-Crossing Operations*, the concept of this phase is to "rapidly place combat power on the far shore to eliminate the enemy's direct fire onto the crossing sites and secure terrain for attack positions."



The previous three days of training paid off when the operation began in earnest and the engineers rapidly and expertly constructed six-bay rafts, which—in an actual operation—would have been used to shuttle significant combat power to the far shore. The mission was clearly a success.

The Results

This unique training event, which coupled the mobility of Army aviation with the capability of the engineer float-bridge equipment, was significant in many ways. Perhaps most important was that the event proved that the 101st Airborne Division not only has the tactical mobility and lethality that sets it apart from other divisions, but it also has the flexibility to react to situations such as that in the opening scenario and quickly overcome it to accomplish the mission.

Although the stated training objectives were to train aircrews and engineers to sling load ribbon-bridge equipment and construct a ribbon-bridge raft properly, the engineer company also learned to set up and run pickup and landing zones properly. In addition, soldiers gained confidence working under the aircraft, and aviators were able to hone their over-water skills for both daytime and nighttime operations.

Captain Handura is a recent graduate of the Engineer Officers Advanced Course at Fort Leonard Wood, Missouri. He was previously assigned to the 326th Engineer Battalion, 101st Airborne Division, Fort Campbell, Kentucky.

The Junior Officer District Intern Program

By Lieutenant Colonel Christopher J. Toomey, First Lieutenant Jeff Qualteri, and First Lieutenant Kevin Truesdell

The 14th Combat Engineer Battalion's Officer Professional Development Program engages the unit's junior officers at multiple levels—from very specific, short-horizon, mission-essential-task-list (METL)-driven tasks to long-term exposure to the opportunities afforded through a career in the Army and the Engineer Regiment. One of the program's recurring components is visits to the neighboring Seattle and Portland U.S. Army Corps of Engineers (USACE) Districts, whose headquarters are close to Fort Lewis, Washington. These tours are always interesting, and most of the battalion's lieutenants and captains—particularly those with engineering and construction backgrounds—find work in the districts intriguing and a source of inspiration to remain on active duty. Recognizing the phenomenal diversity of the Regiment, many are excited about the prospect of serving in USACE Districts following successful company commands.

In an effort to enhance the breadth of junior officers' understanding of work within the USACE and develop construction management skills, the "Rugged" 14th Battalion developed a partnership with several of the districts in the USACE's Pacific Northwest Division. Modeled after the Cadet District Engineer Program sponsored by the United States Military Academy's Department of Civil and Mechanical Engineering, the Rugged Junior Officer District Intern Program (JODIP) places selected junior officers in local districts at the project-engineer level for two to four weeks.

Following the development of the initial concept with commanders of the Pacific Northwest Division and Fort Lewis' 555th Combat Engineer Group, the 14th Battalion approached the Seattle, Portland, and Walla Walla Districts with the idea and met positive responses. The ensuing process involved orchestration around four basic considerations.

- **Assignment**. The battalion asked the USACE Districts to place the officers in project-engineer positions on current construction projects. This does not preclude a district orientation, which is beneficial, but the intent is to place the junior officers in "muddy-boots" positions and expose them to construction and construction management in the field, to include quality assurance and safety.
- **Officer Selection**. The battalion looks for solid performers, typically first lieutenants and junior captains,

1LT Jeff Qualteri served his internship at the Portland District's Bonneville Lock and Dam. He is shown inspecting recently installed ductwork.

1LT Kevin Truesdell, while working in the Fort Lewis Resident Office, Seattle District, conducts quality-control and safety inspections at the McChord Air Force Base Medical Clinic.

with an interest in serving with the USACE. A desirable criterion is an academic background in engineering or construction management.

- **Timing**. A balance must be achieved between timing the officer's assignment with meaningful on-site construction and when the officer can be spared from the unit (normally during a post-support or "red" cycle). In addition, it is recommend that the duration be from two to four weeks with the latter being optimal.
- **Funding**. The unit must decide what it can fund and what the district can fund in terms of travel and per diem, particularly if the project site is far from the home station. Selecting USACE-managed construction projects on the installation can mitigate this cost. To date, USACE Districts absorb all TDY costs.

Two first lieutenants recently participated in the JODIP. One officer spent his assignment at the Portland District's Bonneville Dam. Following a briefing at the district office, he was assigned as a project engineer at the dam, where he completed a quality-assurance plan for rebuilding a 300-ton crane. He also attended a half-day course based on marine-construction cost estimating and learned about and worked with change orders and submittals from the contractor to the engineering department. While at the dam, he observed a final exciter test and an alignment test on a hydropowered generator before it was placed on-line for commercial use. The generator is part of the first powerhouse restoration being completed at the Bonneville Dam. From start to finish, the officer was actively employed, with each day's events scheduled for maximum opportunities. There was an equal balance of educational training and employment on various tasks.

For his internship, the second officer worked for the Seattle District Corps of Engineers at the Fort Lewis Area Office, which is primarily responsible for construction on Fort Lewis and nearby McChord Air Force Base. Assigned to the project site of a new medical clinic at McChord, the officer's responsibilities included processing requests for information and conducting quality-control and safety inspections. While processing requests for information, he worked with the superintendent and quality-assurance officer to determine ways to adjust the design of the building. The quality-assurance inspections were an excellent opportunity to observe the construction trades in action. The safety inspections consisted of daily walks through the project site to ensure that the subcontractors were following both Occupational Safety and Health Administration and USACE guidelines. The officer also had the opportunity to use his technical degree by designing a footing for the clinic's entrance sign.

The JODIP is making a positive impact on the participating officers and the sponsoring USACE Districts. For the officers, the program provides a valuable look at the remarkable diversity of assignments within the Regiment and the Army and allows the officers to get actual hands-on, project-engineer experience. The program also benefits the host district by providing it an opportunity to work and train future project engineers, deputy commanders, and commanders. The program is now broadened to all engineer units at Fort Lewis and is administered under the guidance of the 555th Combat Engineer Group. A third officer recently interned with the Walla Walla District.

At this time, it is difficult to gauge the long-term benefit of the intern program as a vehicle for officer retention. Yet, it clearly will contribute to further educating our junior officers to the vast assignment opportunities available and will serve as another "arrow in the quiver" in making the decision to remain a part of our Army.

Lieutenant Colonel Toomey, a graduate of the United States Military Academy, commanded the 14th Combat Engineer Battalion from 1998 to 2000.

First Lieutenant Qualteri, a graduate of Colorado State University with a degree in civil engineering, is a platoon leader in Charlie Company, 14th Combat Engineer Battalion.

First Lieutenant Truesdell, a graduate of the United States Military Academy with a degree in civil engineering, leads a platoon in Alpha Company, 14th Combat Engineer Battalion.

COSTA RICAN PORTS FACILITIES:

AN ENGINEER SURVEY MISSION

By Captain Tim Scarbrough

Since Hurricane Mitch devastated much of Central America nearly two years ago, the United States Southern Command (USSOUTHCOM) has continued to task United States Army Reserve (USAR) engineers with the assessment and management of theater engineering missions. The source of this collection of expertise is housed at the 416th Engineer Command (ENCOM) of Darien, Illinois, a suburb of Chicago. The 416th ENCOM specializes in technical engineering and engineering management, with areas of responsibility that include Southwest Asia and Central and South America. USSOUTHCOM relies heavily on the 416th's drilling reservists and its full-time staff to provide the best engineering expertise the USAR can muster.

Survey Background

Late in 1999, the 416th ENCOM was tasked to conduct several predeployment site surveys to assess future construction projects. Sites in Costa Rica came to the forefront for analysis in January 2000. An assessment of the cost regarding new construction versus renovation of existing facilities was needed according to bilateral agreements between the United States and Costa Rica. Also needed were detailed engineer surveys to help the Costa Rican Coast Guard combat drug smuggling.

The 416th ENCOM selected a team of three professionals from its reserve and active-duty staff months ahead. The team members' backgrounds collectively reflected a vast knowledge of architecture, building renovation and construction, pier analysis, soils suitability, and surveying. The team arrived in Costa Rica in late January to begin the extensive site surveys required by USSOUTHCOM's tasking.

Coordination with host-nation authorities is essential to any OCONUS mission. The 416th ENCOM's team met with general contractors the night before they left for the survey sites to determine short-term material issues and other related topics. Issues included Costa Rican building codes compared to those in the United States, joint usage of American Concrete Institute (ACI) manuals, and comparison of host-nation materials and construction practices to those used in CONUS. The team found that construction costs in Costa Rica were 20 percent higher than those in the United States and concluded that labor costs were 60 percent lower, including social security and taxes.

Survey Sites

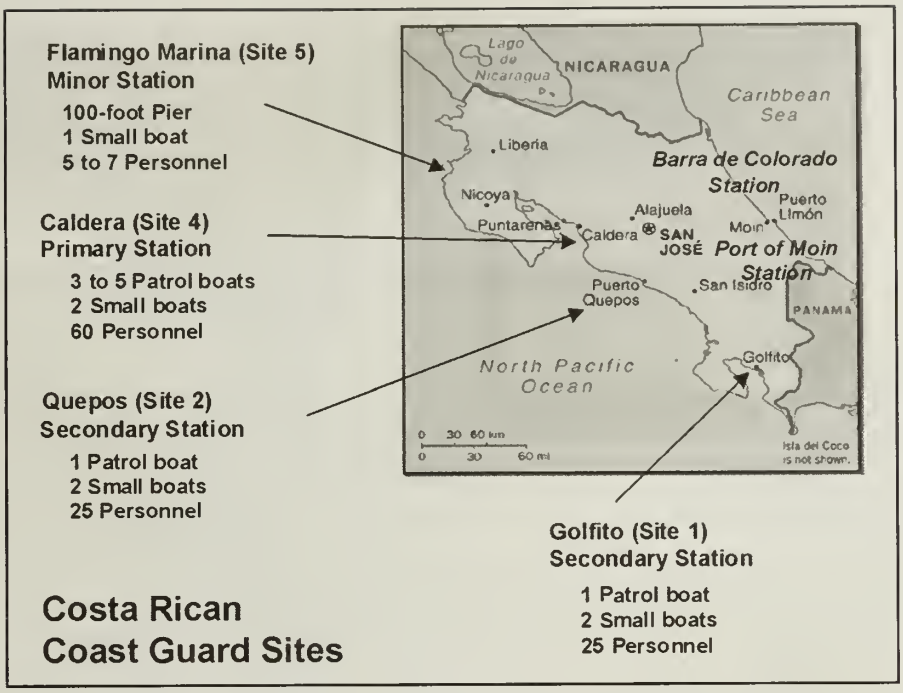
The 416th ENCOM's team assessed six ports along the Pacific Coast: Golfito, Quepos, Puntarenas, Caldera, Flamingo, and Cuanjigil. The intent was to identify four of the six sites for use by the Costa Rican Coast Guard. One of these four sites was to be established as the main station, two sites were to be secondary sites, and one site was to be a substation.

Golfito. For any predeployment site survey, an assessment of surroundings en route to the site is often more important than the proposed construction site itself. The survey team members realized this important fact when they arrived at Site 1, the port of Golfito. They noticed that the port took up a long, narrow area on the Pacific Coast and that there was very little space available for building or expansion. The team learned that Costa Rica had exported bananas through this central port approximately 60 years ago. Over time, the large export companies pulled out of the area and moved their operations to the Atlantic Coast at Limon. To keep the business at the port of Golfito, the Costa Rican government made all local products tax-free so that people would continue traveling there to shop.

This site encompasses a still-used, 60-year-old pier, which was being resurfaced by the National Port Authority for anticipated commercial traffic. A steel warehouse, in critical need of repairs, adjoined the pier and was being converted into administrative offices and living quarters. Collocated on this site were 50,000-gallon, gasoline-storage tanks and a boat-retrieval facility.

Quepos. One hundred miles north of Golfito is Quepos, a small community port used primarily for fishing, which was designated as Site 2. There, unlike at Golfito, a person must cross a peninsula to get to the Coast Guard facility. The 50-year-old facility, primarily made of wood, was unserviceable. The two-story structure, which had 500 square feet of space per story, had a separate latrine on each level. Next door to this facility was a structure, similar in design and age to the Coast Guard facility, that housed the National Port Authority. Accessibility to the pier from this area was a problem because it required crossing an aging steel-trestle bridge that was in very poor condition and heavily used by sport fishermen. At the pier, Coast Guard and commercial vessels shared mooring space, and the height of the fixed pier varied 12 feet between high tide and low tide. Attached to this pier were floating piers used to moor only the fishing boats.

Puntarenas. At Site 3, Puntarenas, it appeared that no land was available for construction, because every square inch was utilized in some way or another. Now, cruise ships dock there frequently, and tourists participate in inland tours, but there are plans to relocate such operations to Caldera.



Flamingo Marina (Site 5)
Minor Station
100-foot Pier
1 Small boat
5 to 7 Personnel

Caldera (Site 4)
Primary Station
3 to 5 Patrol boats
2 Small boats
60 Personnel

Quepos (Site 2)
Secondary Station
1 Patrol boat
2 Small boats
25 Personnel

Golfito (Site 1)
Secondary Station
1 Patrol boat
2 Small boats
25 Personnel

Costa Rican Coast Guard Sites

The substructure of the wharf was in extremely poor condition and unsafe. Most of the facility was more than 70 years old and built on steel and concrete piers, which were more than 80 percent deteriorated. Structural failure seemed imminent unless extensive repairs were made to the undercarriage. Significant problems were noticed, such as ships being stuck in the mud for four hours a day due to the low tide.

Caldera. At Site 4, the port of Caldera, surveys showed that much detailed work would be required before relocating operations there from Puntarenas. Caldera is the largest commercial port on the Pacific Coast of Costa Rica. Each day, large, ocean-going ships handle vast quantities of import and export goods at this facility. Port authorities expressed a great interest and need for Coast Guard port security and protection.

The team assessed the main commercial pier, three large warehouses with offices, and the parking areas. The port is used for commercial fishing and tourism and would provide a good working platform for material storage and equipment staging. Well suited for maintenance, refueling, and construction operations, there was even room for offshore equipment mooring. Very accessible for engineering operations, this facility had all the amenities of an American port.

Flamingo. The team traveled from Caldera through the mountains to Flamingo (Site 5), which has the first marina built in Costa Rica. Used primarily by the sport-fishing industry, the area was being upgraded by a U.S. developer, who planned to more than double its size and include repair facilities. However, he still had to meet government requirements and obtain the necessary permits. Plans also were being made for a dry dock, a petroleum storage and issue area, and pier space for one hundred additional boats. Part of the expansion will include 100 feet of pier space devoted to Coast Guard vessels.

Cuanjigil. Four miles up the coast, the team reached Site 6. Cuanjigil, a very small fishing village about 20 miles from the Nicaraguan border, had constructed a 290-foot pier and a small fish-processing plant. Facilities included 440-volt electrical power, diesel fuel, and water. This was a small fishing-boat area with a low volume of sea traffic.

Survey Results

After touring all of the sites, the predeployment site survey team traveled to San Jose to summarize the data it had collected for a briefing to the U.S. Ambassador and the American Embassy staff. The team concluded that most of the "over-the-water" construction should consist of building the new facility in Caldera. All of the other sites were considered "secondary" and should have some type of simple, floating pier system. All existing structures, both on land and over the water, appeared to need major repairs or, in some cases, were beyond repair. However, with careful management, significant improvements could be made to the ports with a modest amount of funding.

At all of the sites, the survey team observed significant environmental problems, which included sewage systems being discharged directly into the ocean and vehicle batteries being dumped on bare soil, causing contamination.

In the most important part of the assessment—the bottom-line cost estimate—the team concluded that because of high costs, the projects should be prioritized and construction phased in over several years. If troop construction is considered, the availability of U.S. troop labor should be evaluated and properly coordinated. The initial estimated cost for the four sites selected for Costa Rican Coast Guard use ranged from $2 million for renovating the existing facilities to $5 million for new construction. At Caldera, the site selected for the main Coast Guard station, new construction—estimated at $1.9 million—will be required. Whether U.S. or Costa Rican design standards are used will also have an impact on the project's cost. Additionally, a detailed study of the underwater subsurface will be required before the final design of the piers is determined.

Captain Scarbrough is an active-duty project engineer for the 416th Engineer Command. Previously the 416th's Public Affairs Officer, he is the point of contact for issues on military water wells, alternative construction technology, theatre construction-management systems, and training management.

Enhanced Off-the-Shelf Technologies

Help Engineers Prepare for Future Operations

By Major Barrett W. Larwin

Never before in our nation's history have engineer missions in Europe been as complex, varied, and demanding as they are today. Facilitating operations throughout the Balkans, conducting Partnership for Peace and other support missions, facilitating exercises, entertaining and resolving readiness issues, and being actively engaged in contingency planning provide the ingredients for exciting times. While these missions offer us numerous challenges, we take great pride in knowing that we are directly linked to the role our nation is playing in helping shape the international environment where our national strategic interests are at stake.

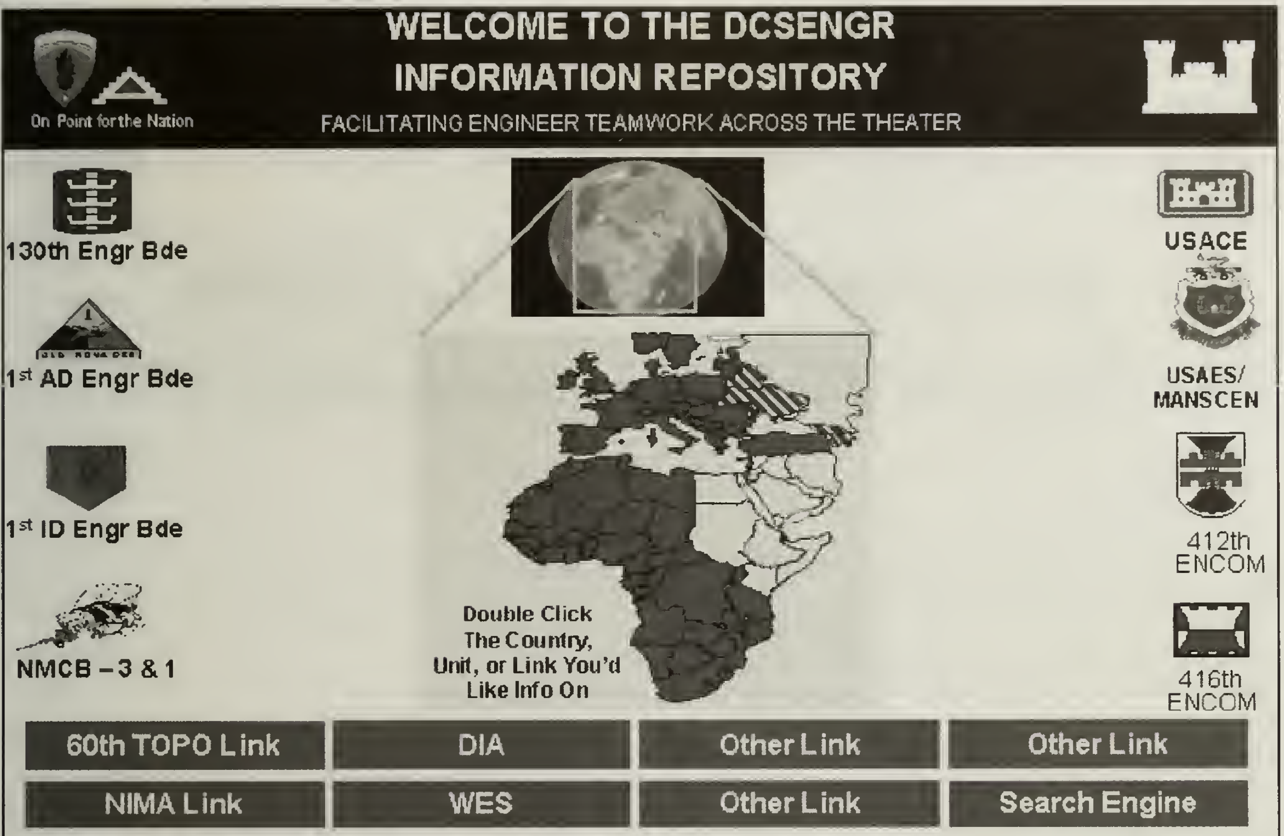
A vexing issue that our United States Army-Europe (USAREUR) engineer staff recently entertained was how to improve the level of support we provide for current and future missions. While no one on the engineer staff would deny the importance of this issue, there was certainly debate over what we could possibly do while our OPTEMPO remains so high. After discounting a number of ideas, we decided to take on projects that we knew we could get approved and see through to completion.

This article provides a retrospect of two projects that our Engineer Operations Division undertook to put its information and communications architecture on the right glide path for the twenty-first century. It describes the capabilities of our new Contingency Operations Center currently in use at our facility on Campbell Barracks, Heidelberg, as well as provide information on the new Engineer Information Repository which is currently available for your use.

Contingency Operations Center

After years of struggling to perform engineer operations in a facility with inadequate communications and a layout that didn't foster an efficient operating environment, the staff set out in July 1999 to give our facility a face-lift. Our goal was to complete a world-class engineer operations center in three months—before our next anticipated contingency operation.

An image of the front of the De Fleury Center. The two forward flat screens and multiple overhead screens give engineers the ability to present as many as four products at one time.



Double Click The Country, Unit, or Link You'd Like Info On

A model of the opening Engineer Information Repository screen. As you scroll your mouse over a country in the USAREUR area of responsibility, the country's name will pop up. Then follow the instructions on the screen.

We identified the location for the center and created a conceptual design using ideas from existing war rooms, local contractors, communication experts, and others with experience in developing similar projects. Like most unfinanced requirements that are pulled together near the end of the fiscal year, we scrambled to definitize the design requirements, acquire the funds, and get the contract awarded before the end of the fiscal year.

After considerable effort, the contract for the DeFleury Contingency Operations Center was awarded on 30 September 1999 with work starting on 10 October. Three months later, most of the construction was complete, and the center was officially opened. It is filled with the latest hardware and communications off-the-shelf technologies. Some of its noteworthy attributes are–

- A completely integrated worldwide architecture entailing voice, video, and data-communication links.
- Eight classified and unclassified workstations with a capability to surge to twenty.
- A TeleEngineering video teleconference (VTC) for point-to-point communications and a multisystem VTC for worldwide compatibility.
- A rotating overhead-projection system with three motorized screens for projecting digital maps and other geospatial imagery.
- Two 60-inch, flat-screen TVs and two multisystem TVs for displaying briefs, CNN, and numerous other products.

All of these features—including the lights, sound system, and ambient controls—are integrated into one touch panel, which gives the operator complete control over all the systems in the room. The operator can control and transfer data from any workstation to any one of the projection or display devices or VTC systems. Although this was an enormous challenge to pull together, we all agreed when it was complete that the headaches were worth the effort. We had effectively modified a twentieth-century structure and created the facilities we need to be an engineer multiplier in future operations.

Engineer Information Repository

Another project, which serves as a complementary initiative to the DeFleury Contingency Operations Center, is the Engineer Information Repository. The goal for this project was to develop a user-friendly information-management database that is capable of storing, linking, and

(continued on page 46)

The Thompson Bend Riparian-Corridor Project:

An Innovative Environmental Solution to a Major Navigation and Flood-Control Concern

By Terrie J. Hatfield

At a bend in the Mississippi River, south of Cape Girardeau, Missouri, and north of Cairo, Illinois, the river flows in a broad, sweeping, reverse curve. This large, meandering loop has created an agriculturally rich, 10,000-acre, peninsula-like land mass known as Dry Bayou-Thompson Bend, located just above the Mississippi River's confluence with the Ohio River.

At first glance, this bend would not appear to present any major problems but, over time, the Dry Bayou-Thompson Bend reach of the Mississippi has experienced such severe and damaging erosion that, during and after flooding, the river has begun to scour and cut a new channel across the peninsula in an attempt to change its course. Now, this change has yet to cause the mighty river to go off in a different direction but, if it were left alone and allowed to have its way and continue this cut-off formation, navigation would become impossible along this 17-mile reach of the river. A new channel, cut across the neck of the peninsula, could not support even the smallest of tows, and the existing channel would be too shallow for navigation most of the time. The velocities would increase manyfold, due to the increased slope upstream and downstream of this reach of river, as the Mississippi would attempt to regain an equilibrium state.

The Thompson Bend project area during the 1995 flood

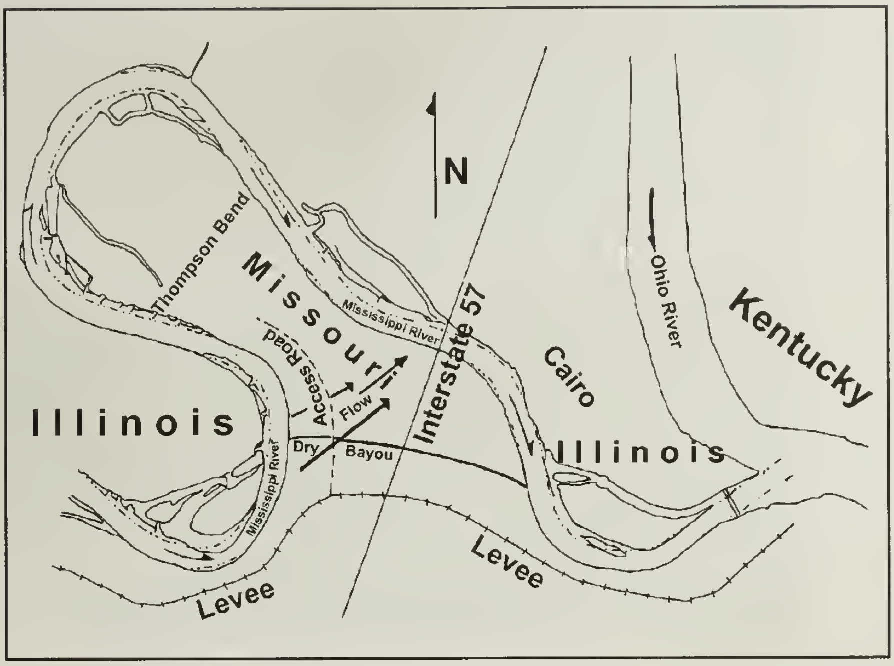
It was evident that if an efficient solution were not soon developed, a navigation crisis—potentially catastrophic to navigation, agricultural, and flood-control concerns—would occur. Southbound traffic would come to a halt at the beginning of the bend, and northbound traffic from New Orleans, Louisiana, could not progress north of Cairo. This midpoint 17-mile reach, if destroyed, would cause a break in the continuous 2,300-mile navigation channel. Navigation on the "Mighty Mississippi," the inland waterway system's busiest highway, would become nearly impossible for transporting a variety of products from the northern United States to the European market. Channel development would be an extremely time-consuming and very costly effort. The magnitude of the scour was such that it was also threatening the integrity of the mainline, Commerce to Birds Point Federal Levee, which protects hundreds of thousands of square miles of property.

A nonstructural, environmentally beneficial way to stop the erosion and repair the damage was needed, but the technology to resolve this kind of problem did not exist. So a 14-year period of trial and error and innumerable experiments began. During this time, the Great Flood of 1993 occurred, in addition to the major flood of 1995, plus many other high-water events of varying duration. Although these events caused setbacks, they also provided valuable opportunities to collect data and evaluate the work that is now known as the Thompson Bend Riparian-Corridor Project.

The result of these many years of hard work was the successful creation of the tree-screen/riparian-corridor concept, which consists of a buffer strip of trees planted between the riverbank and the floodplain. This methodology at this magnitude is a revolutionary and unprecedented blending of various sciences and technologies in an environmentally sensitive and friendly, cost-effective, and mission-essential manner. The project included obtaining permanent easements from the landowners; planting cottonwood clones and other hardwoods specifically bred for their fast growth and water-resistant attributes; and strategically placing various forms of other types of vegetation. The trees will be selectively harvested, in agreement with an arrangement with the landowners and local levee board, so they do not cause too much shade and prevent undergrowth. (A major side benefit of this part of the process is that it also provides timber as a cash crop for the landowners.) Consistent and continuing application of this technology, including ongoing tree planting, has maintained the river in its natural, original channel, and navigation has been sustained around Thompson Bend.

This erosion-control method has been so successful that it is considered by the Corps of Engineers' Mississippi Valley Division to be a prototype demonstration for the entire Corps. The concept is changing the way the Corps deals with severe erosion problems along the nation's waterways, while providing benefit to the environment.

The innovative concept was severely tested by the Great Flood of 1993. Even though approximately 40 percent of the trees were killed in the flood, they stayed anchored in place. The idea worked far beyond expectations. No one realized when they started that a 100-foot wide tree screen would cut flood velocities in half. However, when measured with a Global Positioning System and an Acoustic Doppler Current Profiler, flows measuring 8 to 8 1/2 feet per second going into the screens measured 4 to 4 1/2 feet per second coming out. This led to far less erosion and scour, increased deposition and, eventually, healing. The tree screens planted in the original Dry Bayou high bank in 1986 held even through the 1993 and 1995 floods.



Map of Thompson Bend

Projects such as the Thompson Bend Riparian-Corridor Project are essential to continue the Corps of Engineers' mission of maintaining a safe and dependable navigation channel, while working with the environment in such a way that everyone benefits. The Mighty Mississippi has been around for a long time and will be around for a longer time than any of us can imagine. It is a very big river and, if we all work together to develop viable solutions to the problems it causes, everyone will benefit.

Ms. Hatfield has been with the Defense Department for more than 35 years, most of that time spent as a position classification specialist. She learned of the Thompson Bend Riparian-Corridor Project while conducting classification reviews in the Engineering Division's Hydraulics Branch. Currently serving as a public affairs specialist and editor of the district newsletter, Terrie now has the opportunity and the vehicle to translate some of the district's most outstanding engineering successes into feature stories as a very effective way to convey these achievements to both technical and nontechnical audiences.

Note: The hydraulic engineer who developed the innovative solution to this erosion problem was Jerry Rapp. His technical paper "Preventing a Cut-Off of a Mississippi River Bendway With Tree Screens" was a finalist in the Permanent International Association of Navigation Congress competition and was published in 1989. His technical expertise has become widely recognized in the development of various vegetative solutions for a wide range of overbank and bank-line erosion problems. His research and innovative and environmentally beneficial designs have earned him "expert" status throughout the Corps's Mississippi Valley Division and with other elements of the Corps and a number of environmental agencies and interests, including those in foreign countries.

Confederate Engineers in the American Civil War

By First Lieutenant Shaun Martin

On 16 March 1802, the Congress of the United States authorized President Thomas Jefferson to organize a Corps of Engineers, which "shall be stationed at West Point, New York," and "shall constitute a military academy," with classes beginning in April 1802.[1] The academy progressed from a disorganized and largely unknown institute to one with a record of high academic excellence, producing officers who would make a name for themselves in military and civil affairs. While the graduates of West Point distinguished themselves in different branches within the Army, attesting to the quality of their military education, the curriculum was designed to provide an engineering education to supply the United States with trained engineers.

Jefferson Davis summarized a widely held opinion of the value of West Point graduates in a report made to Congress:

> *Nearly all great public works of the country, the river and harbor works, the lighthouses, and even the public buildings, have been directed by its graduates; they were the pioneers in the construction of railroad, and among the teachers of that art; and the great scientific works of the government have been chiefly conducted by them. The military services of its graduates have been ever more conspicuous than those in engineering and science. The fortifications, the improvements in ordnance and small arms, the conduct of the geographical and other scientific labors carried on in connection with the operation of troops, equally attest the character of the instruction imparted at West Point. Ever since the organization of the government, perpetual Indian warfare has kept the larger part of the Army in active operation on the frontier and in the barren plains and mountains of the interior. The duties are harassing and entail great privation and exposure; they call for the exercise of all the best qualities of the soldier which, tried by this severe test, the graduates have been found to possess in an eminent degree.*[2]

Choosing Sides

On 6 March 1861, after the South seceded from the United States, the Provisional Congress of the Confederate States of America passed "an act for the establishment and organization of the (Confederate) Army." Among other provisions, it called for the establishment of the Confederate Corps of Engineers.[3]

Since the primary source of men trained in the skills of artillery and engineering for the United States was West Point, those who attended classes together, as well as those who provided the instruction, chose sides when the Civil War began. (For example, in January 1861, the superintendent of West Point was Captain P.G.T. Beauregard. Four months later—as a newly promoted general—his troops opened fire on South Carolina's Fort Sumter (see photo at left), a Union fort commanded by Major R. Anderson, who years earlier had been the artillery instructor for cadet Beauregard at West Point.[4])

The Union Army received the greater share of these officers and the experience they brought with them. Of the 65 cadets who had resigned from West Point and accepted commissions in the Confederate Army by May 1861, only seven were in the Corps of Engineers. An additional 13 officers were inherited from the academy faculty, but seven of them were soon detached outside the Corps of Engineers.

With its limited cadre and without a source of training for new engineers, the Confederate Army, like the Union Army, would suffer from a critical shortage of engineer officers. The Confederate Army, however, did a better job of overcoming this shortage. Its establishment of an Engineer Corps and an improvised organization of dedicated engineer troops gained the Confederacy numeric superiority with regard to its engineers.

In 1863, the Confederate Congress passed legislation assigning a company of engineer troops to every division in the field. The troops were to be drawn from each division and selected based on their experience in the mining or construction trades. Each company consisted of 100 men commanded by a captain and three lieutenants. The newly formed companies (4,000 soldiers, who were dedicated to engineer operations) were superior to the Union Army's ad hoc system, which relied on employing soldiers as engineers as needed.[5]

By 1865, the Confederate Army had many more engineer officers in the field than the Union Army. The Confederate Engineer Corps had 13 regular officers, 115 provisional officers drawn mostly from civilian engineers, and an additional 188 nonengineer officers assigned to engineer troops. This compared to the Union's 86 engineers.[6]

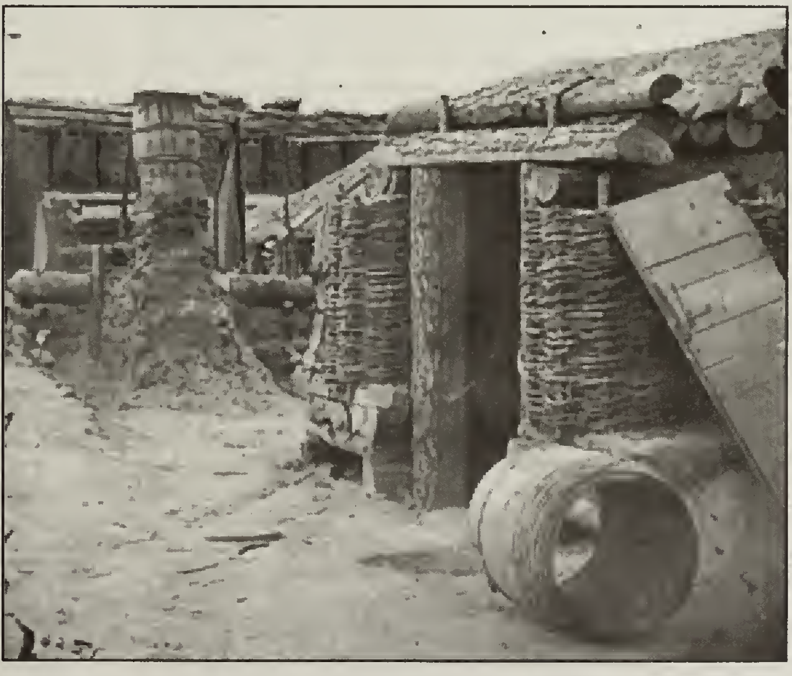
The engineer troops of the Confederacy were generally committed to constructing and improving field fortifications deployed to the coastal and interior defenses, and it was in this capacity that they were superior to their Union counterparts. At times, engineers were used to maintain and improve the Confederate rail system, but here the Union Army excelled, both in its utilization of the engineers and its logistical support of the rail system.[7] The creative use of the resources available was what set the Confederacy apart from the Union. Another lasting contribution of the Confederate engineers was the development of new weapons systems.

Field Fortifications

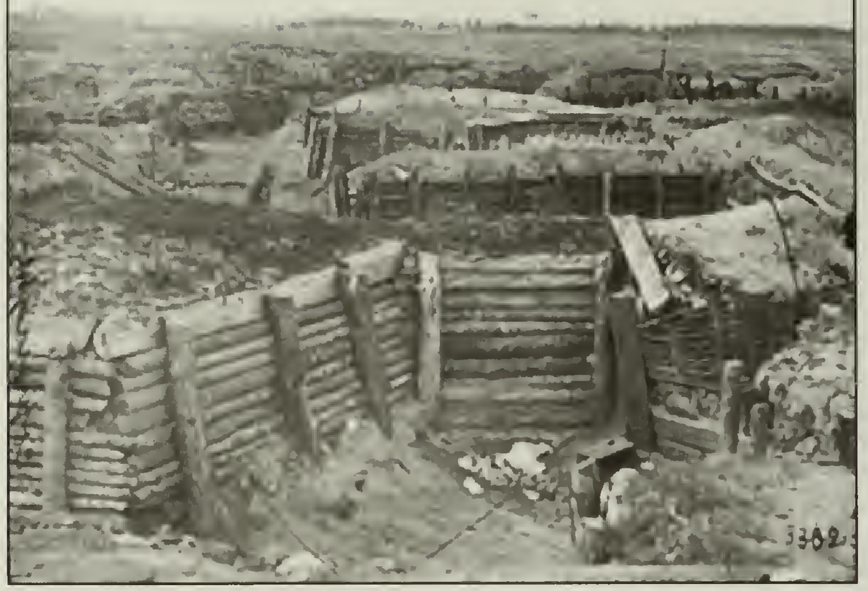
The innovations employed by the Confederate engineer units during the Civil War were remarkable. Field fortifications dominated the Confederate defensive operations and were extensively employed in their offensive operations. A zigzag system of trenches, which had never been used in field operations, protected the approach. Such entrenchment methods previously had been used exclusively for siege operations.[8]

Union Captain Orlando Poe, General William T. Sherman's chief engineer, admired one particular innovation he had observed—the "head log," which was invented to cope with the deadly accuracy of sharpshooters. The head log was described as "a stout log, of hardwood if possible, which is cut as long as possible and laid upon blocks placed on the superior slope for a foot or two outside the interior crest. The blocks supporting the head log raise it sufficiently from the parapet to allow the musket to pass through underneath it and steady aim to be taken, while the log covers the head from the enemy's fire. Frequently, the blocks are replaced by skids which rest on the ground in the rear of the trench so that if the head log is knocked off the parapet by artillery fire, it rolls along these skids to the rear without injuring anyone."[9]

The Confederate Army often demonstrated its skill at strategic defenses in the tactics used by General Joseph Johnston. His troops would construct as many as three lines of fieldworks, including one to their rear. Johnston attended, with meticulous detail, to the general organization and detail of the entrenchment, while the engineer officer of each unit was in charge of the entrenchment, selecting the lines and placing each unit in position.[10] The Union Army routinely left this function to the troops themselves. Poe reported, " The constant practice of our troops has made them tolerably good judges of what constitutes a good defensive line and lightened the labors of the engineer staff very materially." [11]



Interior view of Confederate works



Confederate fortifications at Petersburg

The Union was slow to appreciate the effectiveness of the Confederate defensive tactics. In June 1862, the defense of Vicksburg, Mississippi, under the command of General John Pemberton, was under way. The Confederates threw up two circular fieldworks that were connected by rifle trenches. The Union Army's General Ulysses S. Grant failed to entrench his offensive line or even to entrench his camps. The Union forces staged three assaults, the first on 29 December 1862 with forces commanded by General Sherman. The second and third assaults by Grant's forces were on 19 and 21 May 1863, this time after a six-hour artillery bombardment by land and from the river. Grant captured a few works but could not hold them. On 4 July1863, Pemberton, who was short of food and ammunition, surrendered after defending for 213 days. Grant had employed 220 artillery pieces, while the defenders hardly used any artillery. Pemberton had defended Vicksburg with a force of 18,500 men and lost about 800 during the siege. Grant had engaged about 30,000 men, and his force was almost decimated.[12]

In June 1864, near the end of Grant's Overland Campaign, the Confederate Army again demonstrated the power of its engineers at a crossroads in Virginia known as Cold Harbor. General Robert E. Lee had lost the crossroads while fighting General Grant's forces during the preceding days. Early on 2 June, Lee's soldiers began to erect a defensive works. Although Grant wanted to attack immediately and roll over Lee's forces before they could complete their efforts, his units were unable to complete necessary preparations in time for the sunrise assault. So Grant rescheduled the attack on Lee for dawn on 3 June.

Meanwhile, Lee's men dug frantically throughout the day on 2 June. Confederate engineers from Richmond used long cords marked with small strips of white cloth, expertly laying out the lines to maximize the fields of fire.[13] The earthworks were low-lying and did not look at all impressive. A Union officer recollected, "The country being generally level and only slightly undulating, the sharpest eye could perceive through the woods and fields nothing but faint lines of rifle trenches." [14]

A little before 0500 on 3 June, after a brief bombardment, Grant's forces began their assault on the Confederate positions. The mass charge of nearly 60,000 Union soldiers was shattered in less than an hour. Major General Andrew Humphreys, the Union Army's chief of staff, later tallied the Union losses for the day at 4,517 wounded and 1,100 dead.[15] After the war, Grant wrote, "I have always regretted that the last assault on Cold Harbor was ever made."[16] The Overland Campaign was finished and Grant now focused on taking Petersburg, Virginia, a siege that would last nine and a half months.

A new philosophy had emerged within the Union ranks. After Cold Harbor, General William F. Smith said, "It had become an axiom among both officers and men that a well-defended rifle trench could not be carried by a direct attack without the most careful preparation, nor even then without fearful loss."[17] On 18 June 1864, Union forces tried once more to storm an entrenched Confederate line at Petersburg. Within ten minutes, 241 Union soldiers were killed and 371 were wounded.[18] The message at last penetrated to the highest echelons of the Union command. Until 2 April 1865, when the war was almost over, the mere sight of Confederate field entrenchments ahead terminated many offensive operations at Petersburg.[19]

The Confederacy pursued a strategy of waging a defensive war[20] but, in the offense, its engineer forces were both innovative and highly effective. One especially successful technique involved creating a skirmish line that moved increasingly closer to the enemy's works. The line protected itself by digging individual rifle pits. Working parties then joined the chain of pits into an ordinary rifle trench, which they later strengthened. By this means, entire earthworks could end up within 200 feet of each other.[21]

A number of items for use in the offense were invented out of necessity. One such innovation was the sap roller, a large cylindrical basket that was closed at both ends and filled with rocks and soil. "Sappers" would roll the basket until they were directly in front of the Union positions. The advantage to this was that troops could move onto enemy defensive works while under fire and prepare a rifle trench almost on top of the enemy and be relatively free of the murderous fire the enemy could deliver.[22]

Rail Systems

Besides field fortifications and trench warfare, engineers were responsible for the rail systems that provided transportation for supplies needed by the armies. Dominance of both the rail and waterway transportation systems would contribute greatly to the ultimate victory of the Union forces, but the Confederate forces often made good use of the rail resources available to them throughout the duration of the war.

Like Grant, Lee understood the importance of the rail system during the war and had employed his engineers in the system's maintenance and expansion. Although Lee did not have the use of the waterways that the Union enjoyed, he still needed to move troops and materials. At his disposal, Lee had the Orange, the Alexandria, and the Virginia Central Railroads. The combined system extended from Richmond to within 40 miles of Washington, D.C. However, compared to the Union's Baltimore & Ohio Railroad, the Confederate rail system was very limited in the number of miles of track and the general quality.

The Union dominance of rail transportation was actually strengthened by the decisions of the Confederates regarding their existing system. First, the tracks for the southern rail systems were laid in a north-south direction and were not interconnected—a problem that could have been overcome by laying new tracks. But Congress was slow to respond to Lee's requests, and he expressed his concern in a letter written on 27 April 1861 just after assuming field command.[23] In addition, southern railroads were not subordinated to military needs, in contrast to the organization and administration of railroads in the North.[24] This was a continuous logistical hindrance as Lee anxiously waited for subsistence, fodder, animals, and wagons to arrive via an undependable rail system.

Another shortcoming in the southern rail system was the gauge of the rails. They were not a standard gauge, which meant that troops had to unload materials at junctions and reload them. As the Union Army captured these sections, it upgraded the track to the standards of the existing northern rails. This involved replacing rails with the standard gauge used by the northern rail system and laying new track to connect previously unconnected sections.

In spite of not developing their own rail system adequately, Confederate engineers contributed to pioneering uses of the railroad. For example, they adopted an effective railroad mobilization strategy. In the spring of 1862, Grant threatened the town of Corinth, Mississippi. A significant feature of this battle was the Confederacy's ability to quickly move troops to contest Grant's presence. In an unprecedented rapid concentration of troops, the rail system brought several armies to Corinth, plus newly mobilized regiments from other states. The Confederates lost the battle for Corinth, but they had shown the importance of the rail system in delivering troops to battle.[25] Grant was quick to see this importance and would use it effectively against the Confederates in the future.

Weapons Systems

Confederate engineers were also employed in developing new weapons in hopes of gaining an advantage on the battlefield. Among these was the introduction of a railroad artillery battery. During the Peninsular Campaign of 1862, General Lee suggested that a railroad battery be built for the Confederates. It would be used on the York River Railroad to halt the advance of General George B. McClellan along this line.

On 5 June 1862, Lee wrote his chief engineer, Major W. Stevens, and suggested that the Confederate engineers "construct a railroad ... plated and protected with a heavy gun."[26] He also suggested that mortars be used in a similar manner. Lee hoped the gun would be in action by 6 June; however, it was not available until 22 June. The 32-pound gun was rifled and banded and weighed 5,700 pounds. Mounted on a railroad flatcar, it was protected in front by a sloping iron-plated shield through which a porthole had been cut for the muzzle of the gun. The sides of the car were protected with timbered walls that were lined with iron. The basic ammunition load consisted of 200 rounds, including a number of 15-inch solid bolt shot. The gun was first used at Savage's Station, Virginia, on 29 June during the Seven Day's Battles. The gun, under command of Lieutenant James E. Barry, was pushed near a rail bridge near the depot. He was to clear an obstruction emplaced by the Union troops and rake the infantry in the valley below with fire. He accomplished his mission with a terrible effect. The Union infantry's attempted assault on the gun was repulsed, and the Union suffered heavy losses.[27]

Conclusion

The Confederacy was never able to gain dominance in rail transportation, and the new breed of weapons and tactics introduced by the ill-fated nation's engineers did not provide the edge they needed to win the Civil War. However, the Confederate engineers' battlefield tactics changed the face of warfare, forever allowing commanders to mass and redeploy troops and transport supplies with previously unimagined rapidity and effectiveness. On the battlefield, the engineers demonstrated with gory clarity the contributions they could make. The innovations they introduced were the foundation of warfare of the future.

First Lieutenant Martin is a support platoon leader with the 162d Engineer Company, Oregon Army National Guard. A mechanical engineer, he is pursuing an advanced degree in design at Oregon State University.

Endnotes:

[1] Stephen Ambrose, *Duty, Honor, Country: History of West Point*, Baltimore: The Johns Hopkins Press, 1966, p. 22.

[2] Report of the Commission, Senate Document No. 3, 36th Congress, 2d Session, Washington, 1860, pp. 56-57.

[3] Richard P. Weinert, " The Confederate Regular Army," *Military Analysis of the Civil War*, ed. Military Affairs, New York: KTO Press, 1977, p. 17.

[4] Ambrose, p. 22.

[5] John H. Westervelt, *Diary of a Yankee Engineer*, ed. Anita Palladino, New York: Fordham University Press, 1997, pp. 47-59.

[6] Edward Hagerman, *The American Civil War and the Origins of Modern Warfare,* Bloomington and Indianapolis: Indiana University Press, 1988, pp. 236-239.

[7] John Prados, "How Many Roads to Richmond?" *The Quarterly Journal of Military History*, Vol. 12, No. 2, 2000, p. 55.

[8] Ibid., pp. 54-55.

[9] W.T. Sherman, *Memoirs*, Bloomington: Indiana University Press, 1957, pp. 117-118.

[10] Fitzhugh Lee, *General Lee*, New York: Greenberg D. Appleton and Co., 1894, p. 138.

[11] Sherman, pp. 38-39.

[12] Noah Andre Trudeau, "The Walls of 1864," *The Quarterly Journal of Military History, Vol.* 6, No. 2, 1994, pp. 24-26.

[13] Ibid., pp. 29-30.

[14] Barron Deaderick, *Strategy in the Civil War*, Harrisburg: The Military Service Publishing Company, 1946, p. 103.

[15] Trudeau, p. 30.

[16] Ulysses S. Grant, *Personal Memoirs,* New York: World Publishing Co., 1952, p. 96.

[17] Deaderick, p. 122.

[18] Ibid., p. 147.

[19] Trudeau, p. 31.

[20] James M. McPherson, "Failed Southern Strategies," *The Quarterly Journal of Military History,* Vol. 11, No. 4, 1999, p. 62.

[21] Hagerman, p. 199.

[22] Ibid., p. 330.

[23] Moxley G. Sorrel, *Recollections of a Confederate Staff Officer,* New York: Neal Publishing Co., 1905, p. 784.

[24] Hagerman, pp. 146-147.

[25] Prados, p. 55.

[26] Lee, p. 288.

[27] Stansbury Haydon, "Confederate Railroad Battery," *Military Analysis of the Civil War*, ed. Military Affairs, New York: KTO Press, 1977, pp. 291-294.

(continued from page 39)

retrieving a wide range of information products on both the secure and nonsecure Internet protocol routing (SIPR/NIPR) networks.The need for this project was identified after realizing that years of hard work had been electronically filed and boxed with little or no cataloging system for future retrieval. As a result, planners have spent hours digging through old boxes and scanning various disks and hard drives trying to locate good historical products they knew existed. When products weren't found, planners were forced to work from scratch and duplicate the efforts expended by their predecessors. This predicament served as a powerful motivator to get this engineer management system and repository designed and in place as rapidly as possible.

To assist in the development of this repository, we turned to the Waterways Experiment Station's (WES's) Tele-Engineering services in Vicksburg, Mississippi, for technical assistance. In short, our engineer planners developed the objective system and functional requirements, and WES successfully turned these requirements into a user-friendly engineer-information application.

The repository is designed with drag-and-drop functionality and drop-down menus, which will provide users a means to find and download various engineer products quickly and easily. It is being developed as a Web browser using Microsoft® Access 2000 and is organized by each country in the USAREUR area of operation.

The opening menu portrays a map of the European geographical region. Each country on the map has a trigger symbol linked to the primary table for that country. The primary tables have information organized into a minimum of 18 areas, to include military capabilities, U.S. military operations, topography, routes and bridges, ports, airports and airfields, power and water, useful Web sites, and other engineer-related topics. Subordinate tables have various forms of informational products, internal links to products in the database, or external links to Web sites where products you are interested in exist. The repository is also designed with a search engine to guide users directly to all its available products. This repository will be open for outside use in October 2000. The secure and nonsecure Web sites are available from the USAREUR ODCSENGR's home page.

Working Together

The DeFleury Contingency Operations Center and the Engineer Information Repository reflect two initiatives that the ODCSENGR personnel took on to supercharge their engineering capabilities and help them provide better and faster support to future operations. These projects illustrate what we, as individual staffs or units, can accomplish when we take the time to identify what's truly vital to our mission and then work together to make it happen.

Major Larwin is Chief of Plans and Exercises, DCSENGR, Heidelberg, Germany.

PERSCOM Notes

By Sergeant Major Theressa J. Fillmore

Communication

Communication is the key to working with the Engineer Branch on assignment and professional-development issues. It is critical to keep an active dialogue between you, your command, and this branch. Communication gives us advance notice of your concerns, such as readiness, pending operational deletions and deferments, commanding-general/general-officer interest, structure changes, personal wishes, and anything else that could have an impact on the assignment process.

There are many ways of communicating with your assignments branch: a telephone; personal letters; the Interactive Voice Response System (IVRS); branch field visits; e-mail, newsletters; a fax machine; personal visits; PERSGRAMs; PERSCOM Online; and the Department of the Army (DA) Form 4187, *Request for Personnel Action*. All of these methods help us stay in touch, but some are better than others.

The best way for a soldier to communicate with the Engineer Branch is to submit a DA Form 4187 with the recommendation or concurrence of the chain of command. We require that most 4187s be processed through the entire chain. While we appreciate courtesy copies, they only provide advance notice of a pending action and add to our paperwork. Although we do accept faxed requests when operating within a shortened timeframe, most personnel actions do not require faxing. Remember, faxed personnel requests must include the recommendations and concurrences from the required level of command, or we will not take final action.

The e-mail option, while often used, does not keep the chain of command informed of a soldier's actions. For this reason, we do not consider e-mail requests official except in certain cases, such as replies to Homebase/Advance Assignment Program (HAAP) changes generated by the branch. However, we do reply to e-mails as quickly as possible. These inquires must include your full name, rank, and primary military occupational specialty (PMOS), but do not include your social security number.

We welcome personal visits to PERSCOM. Although advance notice is not required, it is helpful to ensure that your assignments manager or professional-development noncommissioned officer (PDNCO) is available.

We also encourage telephone calls and personal letters. In the Engineer Branch, we believe that soldiers should have input in their future. When calling, we need your name, rank, and PMOS to quickly connect you with the correct assignments manager and/or PDNCO.

Soldiers primarily use the IVRS (1-800-FYI-EPMD [394-3763]) to determine if they are on assignment instructions. However, it also gives information on schools, retention management, and other enlisted topics. You need a touch-tone telephone to use the IVRS and must provide your social security number.

Branch field visits usually are scheduled at the request of the installation or major command. We conduct these visits to keep the field informed of engineer and Army issues and to conduct face-to-face interviews with the soldiers we serve.

PERSCOM Online (*http://www-.perscom.-army.mil*) is a PERSCOM Web site. The Engineer Branch maintains a portion of the site with assignments, promotions, and other data available for engineer soldiers. It is a good source of information on special assignment qualifications—such as drill sergeant, recruiter, Active Component/Reserve Component—and where engineer MOSs are authorized. The site also includes the telephone numbers and e-mail addresses of all branch personnel in the Enlisted Engineer Branch. The majority of PERSCOM Online has information relevant to all soldiers, not just engineers.

Last, but not least, is the HQDA PERSGRAM, which is used to notify soldiers of PERSCOM-generated actions such as assignments and schools.

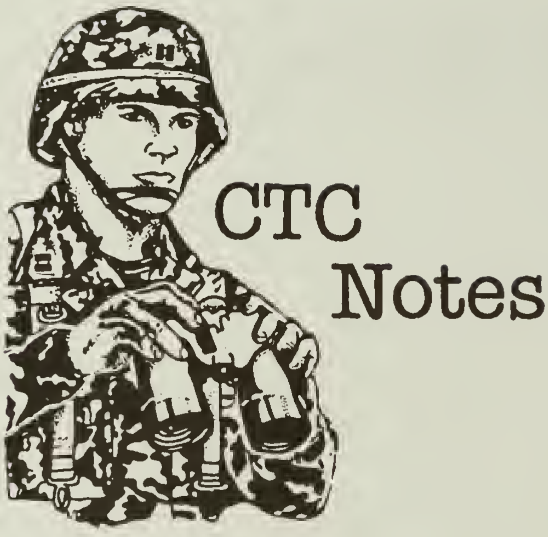
As you can see, there are many ways to communicate with your branch. These avenues are open to leaders and soldiers, and we highly encourage you to use them. We can't know everything that may impact on your next assignment or school unless you or your leaders tell us. The sooner we know, the better. You do not have to wait until you are on assignment instructions to get in touch with us.

MYTH: If you call DA, your next orders will be to Korea.

FACT: While Korea is a valuable assignment, we do not place soldiers on any particular assignment just because they called.

Your voice in the professional-development and assignment process is important to us. The following site on PERSCOM Online provides the telephone numbers and e-mail addresses to contact your branch assignment managers and PDNCOs: *http://www.-perscom.army.mil/EPeng/engdir.htm.*

Sergeant Major Fillmore is the sergeant major of the Engineer Branch.



Combat Maneuver Training Center

Product-Focused Planning

By Captain Ted Read and Major Tom Smith

During recent rotations to the Combat Maneuver Training Center (CMTC), engineer battalions have shared the training objective of "surging" the battalion staff during the brigade's military decision-making process (MDMP) and also improving its own MDMP. However, the battalions typically do not arrive with tactics, techniques, and procedures (TTP) on how to accomplish this goal. By the end of a rotation, the battalion staff reaches a norm on how to plan, but it may be inefficient and limit the positive impact of the engineer battalion staff. A technique to address this problem is for the battalion to arrive at the CMTC with an MDMP SOP. A simple way to develop this SOP is to use a product-focused matrix that identifies products required from each staff member by time/phase of the engineer- and maneuver-brigades' MDMPs. The matrix fixes the responsibility for specific products, by phase, and ensures that the staff acts within the brigade combat team's decision cycle.

The first step is for staff members to review tasks and responsibilities for each step of the MDMP. While Field Manual (FM) 101-5, *Staff Organization and Operations*, is the Army's capstone manual for MDMP, staff members should also review key manuals for engineer integration into the brigade combat team—FM 5-7-30, *Brigade Engineer and Engineer Company Combat Operations (Airborne, Air Assault, Light)*, and FM 5-71-3, *Brigade Engineer Combat Operations (Armored)*—as well as functional manuals such as FM 20-32, *Mine/Countermine Operations*; FM 90-7, *Combined-Arms Obstacle Integration;* and FM 3.34.2 (formerly FM 90-13-1), *Combined-Arms Breaching Operations*. The goal is for each staff member to answer five questions:

1. What products do I owe the engineer and maneuver commanders?

2. What products do I owe the engineer and maneuver staffs?

3. What products do I owe subordinate commands?

4. When do I owe these products?

5. Who synchronizes production and reviews the product before publication?

Note that FMs 5-71-3 and 5-7-30 crosswalk the maneuver-brigade and engineer-battalion actions during each step of the MDMP but do not fix responsibilities for products from specific staff members.

The second step is to synchronize tasks and responsibilities by time and staff member. The battalion executive officer is the key player in delineating the level of staff participation and the breakdown by phase. During this step, challenge the availability of staff personnel and the timing of products. As conflicts develop, weigh the criticality of the information or product and possible alternate staff members or means to provide the information. The end state is a matrix that lists critical tasks and products by staff section with a no-later-than (NLT) time of production. The matrix becomes a living document ready for execution, preferably at a command-post exercise before the rotation. More details can be added by increasing the specificity of tasks, increasing or further defining the staff participation to staff NCOs and below, and dividing the times/phases into smaller steps. Another level of refinement is possible if the matrix becomes mission-specific (for example, a different matrix for defend, movement-to-contact, or deliberate-attack missions).

Provided on page 49 is a simple example of the planning matrix, intentionally limited to three phases (receive mission, issue warning order (WARNO) #1, and brief the engineer mission analysis). It is not definitive! The unit matrix SOP should be the result of individual staff analysis by phases defined by the executive officer. It should account for your tactical-operations center's (TOC) organization and the brigade combat team's likely battle rhythm.

A primary benefit of this format for developing an MDMP SOP is flexibility. As the staff refines tasks and responsibilities, the matrix easily expands. It also trains a synchronization technique commonly used in tactical units. Used properly, it accomplishes the goal of surging the staff on the brigade's MDMP and improving the battalion's MDMP process.

Captain Read is the engineer observer/controller (O/C) for the Armor Task Force O/C Team at the CMTC in Hohenfels, Germany. He was previously assigned to the 9th Engineer Battalion, 1st Infantry Division.

Major Smith, the senior engineer O/C at the CMTC, was previously the executive officer for the 54th Engineer Battalion, Bamberg, Germany.

Product-Focused Planning Matrix

	Receive Mission	Issue WARNO #1	Brief Engineer Mission Analysis
CDR	• Analyze mission. • Provide initial guidance.		• Issue commander's guidance. • Direct focused precombat inspections on misson-critical equipment.
XO	• Develop timeline. • Prioritize planning assets. • Send a logistics planner to the assistant brigade engineer (ABE). • Focus rear-command-post planning tasks. • Verify current status.	• Issue WARNO #1. • Consolidate products for mission-analysis briefing.	• Coordinate the mission-analysis briefing to the commander. • Nest timeline within the brigade's timeline. • Receive commander's guidance. • Issue WARNO #2.
S3	• Verify initial guidance with the brigade S3/XO. • Identify operational tasks. • Identify operational shortfalls. • Identify critical tasks.	• Prepare operation portion of the mission-analysis briefing. • Prepare mission statement. • Approve ABE portion of the brigade's mission-analysis briefing.	• Brief operational piece of the mission-analysis briefing. • Be prepared to send a planner to the brigade's course-of-action (COA)-development meeting.
ABE	• Copy order for battalion. • Develop a friendly engineer estimate. • Identify engineer tasks. • Submit engineer-specific priority information requirements. • Update the Dirty Battlefield Overlay and have it available for mission-analysis briefing. • Pass specific verbal guidance from the brigade command group to the engineer battalion's TOC via the S3 or XO.	• Receive products from staff for brigade's mission-analysis briefing. • Work to get brigade-specific release authority of SCATMINEs. • Work with S2 on R&S routes. • Work with S2 on engineer-specific named areas of interest (NAIs).	• Attend engineer battalion's mission-analysis briefing. • Receive engineer commander's guidance. • Incorporate the commander's guidance into the brigade's mission-analysis briefing.
S1/S4	• Identify combat-service-support (CSS) tasks. • Identify CSS shortfalls. • Identify critical log task. • Update Class IV/V status. • Update equipment status and project the mission's NLT time.	• Prepare CSS portion of mission-analysis briefing. • Receive status from rear command post.	• Brief the CSS portion of the mission-analysis briefing (focus on mission-critical supplies and equipment). • Receive commander's guidance on priorities of supply and maintenance.
S2	• Develop TerraBase shots of key terrain and objectives. • Review and update the modified combined obstacle overlay (MCOO). • Conduct NAI analysis with the brigade S2. • Develop an enemy engineer estimate.	• Work with brigade S2 for NAI TerraBase products. • Prepare enemy engineer portion of the mission-analysis briefing.	• Brief enemy portion of mission-analysis briefing. • Receive TerraBase guidance.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Active Duty Service Obligations (ADSO) Change to Partially Funded Degree Programs. If a proposed change to AR 350-100, *Officer Active Duty Service Obligations*, is approved, the ADSO will increase for UMR graduates for an additional 12 months after they receive tuition assistance. The change indicates that officers who participate in a partially funded program will incur a three-for-one ADSO for time spent in civilian education with a minimum ADSO of two years. Currently, the ADSO does not significantly extend an officer's commitment after degree completion. Of the officers polled who are current UMR students, 94 percent said they would still use tuition assistance if this change were in effect today. The effective date of the new policy is to be determined.

POC is CPT David Cushen, (573) 596-0131 ext. 3-7231, or DSN -7231, or e-mail *cushend@wood.army.mil.*

New Engineer Branch Video for ROTC/USMA Cadets. The Engineer Branch recently completed a new video, which is being distributed to ROTC detachments and the USMA. The updated video includes illustrations of our diverse missions and information concerning in-service and postservice benefits and portrays the current status of the Engineer Regiment.

POC is CPT David Cushen, (573) 596-0131 ext. 3-7231, or DSN -7231, or e-mail *cushend@wood.army.mil.*

Reserve Engineer TASS Battalion Instructors Needed. Resourcing of the TASS battalions by the institutional training divisions and brigades continues to be critical. Instructor strength is the primary challenge. All training battalions continue to need additional engineer instructors. If a quality engineer NCO (E6 or E7) is leaving active duty, he is needed as an instructor in the U.S. Army Reserve Engineer TASS Battalions.

POC is MAJ James Avants, -4114, or e-mail *avantsj@wood.army.mil.*

Engineer Officer Advanced Course. The construction module of the advanced course is being updated with a new capstone exercise based on the Bosnian theater of operations. Also, a quality-control/quality-assurance class is under development, which will be incorporated into the existing project-management lesson.

POC is CPT Tim Scholma, (573) 596-0131 ext. 3-5372, or DSN -5372, or e-mail *scholmat@wood.army.mil.*

Mine Awareness/Unit Mine-Advisor Train-the-Trainer Course. The Countermine Training Support Center (CTSC)/Humanitarian Demining Training Center (HDTC) projects that the pilot for this course will be in July 2001. The intent of the course is to teach senior NCOs and junior officers to develop and conduct unit mine-awareness training properly and to serve as unit mine advisors during deployments. Course graduates will be designated "trainers" from active and reserve engineer battalions and brigades throughout the force. The CTSC will teach this five-day course at Fort Leonard Wood on a cyclic basis, prioritizing instruction for those designated to deploy to mine-contaminated regions such as Bosnia and Kosovo. We anticipate space for up to 30 students, so please call to reserve positions. Units will be required to fund associated TDY costs. For more information, visit our Web site at *http://www.wood.army.mil/CTSC.*

POC is Dr. Steve Grzyb, -6199, or e-mail *grzybst@wood.army.mil.*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals have recently been printed and distributed:

- FM 3-34.2 (formerly FM 90-13-1), *Combined-Arms Breaching Operations*, dated 31 August 2000.
- FM 3-34.230 (formerly FM 5-105), *Topographic Operations*, dated 3 August 2000.

These manuals also are available for viewing and downloading from the Reimer Training and Doctrine Digital Library. To access the library, go to *http://www.adtdl.army.mil/atdls.htm* and click on "Enter the Library." Select (highlight) "Field Manuals" on the left drop-down menu and "Engineer" on the right drop-down menu. Click on "Submit."

FM 3-34.331, *Topographic Surveying*, will be sent to print within the next 30 days. Look for it on the MANSCEN Publications Page at *http://www.wood.army.mil/PUBS/newpubs/htm*. This manual combines FM 5-232 and TMs 5-232 and 5-237 and is a guide for military occupational specialty (MOS) 82D (topographic surveyor). It provides techniques not found in any commercial text concerning the precise determination of position, azimuth, or elevation of a point. Additionally, this publication describes and standardizes procedures for performing recons, preparing station descriptions, and reporting and briefing survey projects.

POC is Sandra Gibson, -4100.

2000 Engineer Unit Directory. The directory, which is updated periodically, is available at *http://www.wood.army.mil/PUBS/dsd/dsd.htm*. Units may submit changes/corrections at any time via e-mail to Jennifer Morgan at *morganj@wood.army.mil*.

POC is Jennifer Morgan, (573) 596-0131 ext. 3-7644, or DSN -7644.

News and Notes

MOS 52E Prime Power Production Specialist. The U.S. Army Prime Power School is looking for self-motivated soldiers who meet the following prerequisites:

- Be an E-5 (nonpromotable) or an E-4 or E-4 (promotable) (subject to career-field requirements).
- Hold a high school or a General Education Development (GED) diploma.
- Score at least 110 on the Armed Services Vocational Aptitude Battery (ASVAB) in the electronics (EL), general technical (GT), and skilled technical (ST) areas.
- Score at least 70 percent on the Basic Mathematics and Science Proficiency Test (BMST).

Located at Fort Belvoir, Virginia, the school teaches the skills associated with installing, operating, and maintaining the Army's largest electrical-power plants. The one-year Prime Power Production Specialist Course is among the Army's most technically challenging training. The benefits include earned college credit, great assignments, promotion opportunities, and worldwide travel while conducting prime-power missions. The schedule for the course is as follows:

Class 01-1 Report date: 26 February 2001
Start/Class date: 12 March 2001
End date: 01 March 2002

Class 01-2 Report date: 27 August 2001
Start/Class date: 12 September 2001
End date: 30 August 2002

POC is Dennis Calamita or Nilia Kondratiuk, (703) 806-3904/3748, DSN 656-3904/3748, or e-mail *249PPSDEADMIN@EN249.usace.army.mil*.

Defense Mapping School Courses. The Defense Mapping School, located at Fort Belvoir, Virginia, is offering the following FY01 resident courses. More information about resident course offerings can be found at *http://www.nima.mil*.

Geospatial Information and Services Staff Officer Course

001	16 October 2000	20 October 2000
002	04 December 2000	08 December 2000
003	22 January 2001	26 January 2001
004	19 March 2001	23 March 2001

Geospatial Digital Data Users Course

001	23 October 2000	27 October 2000
002	13 November 2000	17 November 2000
003	29 January 2001	02 February 2001
004	09 April 2001	13 April 2001
005	07 May 2001	11 May 2001

Topographic Operations Management Course

001	26 February 2001	09 March 2001
002	13 August 2001	24 August 2001

Remote Sensing and Geographic Information Systems

001	06 November 2000	20 November 2000
002	12 March 2001	23 March 2001
003	18 June 2001	29 June 2001
004	20 August 2001	31 August 2001

POC is Ms. Lynn Keleher, (703) 805-3213, or DSN 655-3213. Alternate POC is at (703) 805-2237, DSN 655-2237.

Defense Technical Information Center (DTIC) 2000 Conference. The DTIC will host its annual users' meeting and training conference from 6 to 9 November 2000 at the DoubleTree Hotel, Rockville, Maryland. This year's theme is "Information Solutions for the Twenty-First Century."

DTIC 2000 provides a unique opportunity for attendees to explore in detail new developments not only at the DTIC but throughout the federal technical-information network. As in past years, the conference will feature a number of presentations and sessions that focus on the most current issues relative to the research, development, and acquisition communities. These sessions are designed to acquaint the participants with the latest policy and operational developments and will provide practical details on valuable and diverse domestic and foreign information resources. The sessions will also address security issues, the World Wide Web, copyright laws, and the storage and dissemination of electronic documents.

POC is Julia Foscue, (703) 767-8236, or e-mail *jfoscue@dtic.mil.* The DTIC home page is at *http://www.dtic.mil.*

22d Army Science Conference. Sponsored by the Assistant Secretary of the Army (Acquisition, Logistics, and Technology), the 22d Army Science Conference will be held at the Renaissance Harborplace Hotel, Baltimore, Maryland, 11 to 13 December 2000. The conference theme is "Accelerating the Pace of the Transformation to the Objective Force." The conference will feature presentations of papers and posters judged best among those submitted by Army scientists and engineers. Authors of the most outstanding papers will be selected to receive special recognition and awards.

POC is at (757) 357-4011 or e-mail *asc2000info@aol.com* or visit the conference Web site at *http://www.asc-2000.com.*

Web Site for Company Commanders. Eight Army officers have founded a Web site that is dedicated to improving company-level leadership in the Army. The site, *http://www.CompanyCommand.com,* is a user-driven forum in which former and current company commanders share their best ideas, products, and lessons learned to benefit current and future company commanders. The goal of the Web site is to improve institutional knowledge at the company level of Army leadership by improving the lateral flow of information.

The eight officers, who are assigned to the staff and faculty at the U.S. Military Academy, run the Web site during their off-duty hours without remuneration. Their sole focus is on helping leaders to grow great units and soldiers.

POC is CPT Peter G. Kilner, (845) 938-4764, or e-mail *cpkilner@aol.com.*

Lead the Way

Command Sergeant Major Arthur Laughlin
U.S. Army Engineer School

I recently went to a conference at Fort Monroe, Virginia, on the transition of TRADOC. The conference was a planning/brainstorming meeting. It dealt with everything in TRADOC from how the schools are organized to how the Army grows and trains leaders, what is taught during Initial Entry Training (IET), and what the school requirements will be for soldiers in their careers. There were a lot of ideas with no final decisions being made. Change, however, is not far off.

I consider this one of the most important times in our Army and our branch. Everything is on the verge of change, and not since the elimination of the horse has there been such dramatic turbulence in the structure of the Army. You may well have to serve in three types of force structure: the legacy force, the interim force, and the objective force. These are all going to be around at the same time until the transition is finished and, for many of you, that will take until the end of your career. Each structure may give you a different relationship with the maneuver force and the logistic chain and a different mix of soldiers and equipment. The training requirements will be different from unit to unit, and the OPTEMPO will vary.

The Chief of Staff of the Army tasked the EPMS XXI Task Force to conduct a comprehensive study of the Enlisted Personnel Management System and recommend changes to ensure continued readiness into the twenty-first century. The idea is to create better ways of managing the force so that soldiers are not stranded in their careers with no way to progress. The different force structures may require you to have different skills for the same MOS. The equipment will be different, the soldier mix will be different, and the support relationship will be different. Therefore, your skills will also have to be different. These changes mean that each of you has to be ready to change. These changes mean that you will have to learn new concepts and new ways of getting the mission accomplished. This will be an Army for people who are serious about soldiering and fearless in the face of the unknown. This will be an Army for engineers.

What will not change are the values that we live by and the requirement for leadership. The force will still be made of people expected to come together to accomplish the mission of defending the nation. Engineers will still be a vital part of that mission, and each one of you will be expected to carry more than your share of the load, just like engineers have always had to do when the Army was changing. I know that the easy thing to do is to say enough is enough and go do something else before the wave of change washes over you. But before you decide that enough is enough, remember that your leaders will stay and help mold this new force. Your leaders will embrace the change and make a difference.

This will be my last article to the Regiment and *Engineer*. I will be replaced by a very capable Command Sergeant Major–Robert R. Robinson II, who is coming from HHC 555th Combat Engineer Group, Fort Lewis, Washington. I know that you will provide the same outstanding support to him that I have experienced while serving as your Command Sergeant Major.

In leaving I would like to thank all of you, the soldiers and noncommissioned officers, for all you have done. By giving me your concerns and feedback, we have been able to continue doing something very important—making a difference.

NCOs, you must continue to lead and train our soldiers as we have done for so long. Do not be afraid of change; embrace and master it. You and your subordinates will be better for it. If called upon to assume a position of greater responsibility, do so gladly. Someone has faith in your abilities—be proud of that fact.

Take care; I will not soon forget the adventures so many of us have lived.

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ENGINEER

The Professional Bulletin of Army Engineers

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UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Mine Threats

ESSAYONS

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U.S. Army Engineer School

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UNITED STATES ARMY ENGINEER SCHOOL

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Front Cover:

Mine threats in mission areas are real. Photographs show various mines and damage that can occur to vehicles from mine explosions. (Engineer Corps flag photograph by Mark Dean.)

Back Cover:

"We Clear The Way!" Engineers - The Proud Tradition. This historical painting was rendered during WWII by famed war poster artist Jes W. Schlaikjer.

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

I am honored to be "back home" at the Home of the Engineers—Fort Leonard Wood. And I must say, the place has never looked better; the Maneuver Support Center is in full swing with great teamwork among the Military Police, Chemical, and Engineer Schools. I appreciate the tone of synergy that LTG Bob Flowers inspired during his command here; we all congratulate him on his promotion and selection as the 50th Chief of Engineers. We also congratulate Ron Johnson on his promotion to BG and thank him for his great work running the Engineer School and ensuring a seamless transition between commandants. The Engineer School will continue that vitally close liaison with the Chief, USACE, and Engineers in the field round the world in the spirit of "One Corps, One Regiment, One Fight." I see this post as a beacon of what is to come in TRADOC and the Army. Fort Leonard Wood is an enduring installation that is demonstrating how branches can maintain their proponency power and technical veracity while breaking down the stovepipe walls and working together to support the maneuver forces of our transforming Army. Clearly the power of the team is greater than the sum of its parts.

It's an exciting time to be an Engineer and a sapper! We are on the cutting edge of change in our Army and our Regiment. We Engineers must be an integral part of the Transformation effort; leaders down to battalion level must have their heads in this game. We owe you the leadership, azimuth, and dynamics of this effort; we will ensure that you know our priorities and issues for the Legacy, Interim, and Objective Forces. I encourage all Engineer leaders to share their ideas with the Engineer School on how to best transform our Regiment in pace with the Army. As we transform in systems, units, and operational concepts, we must be willing to part with the old. Remember, the old stuff never was perfect; we always wanted better, and we survived by making compromises and applying unit-level innovations along the way. Now is the time to catch up—that's why we Engineers should regard Transformation as an opportunity and an exciting challenge. Remember, the power and genius of our branch has always been its people, not its equipment.

One of my most compelling priorities is to establish and maintain an effective network with you—the leaders of our Regiment. I see support to and dialog with the field as the fountain of our wisdom; the key to our success in doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS); and the vehicle for our "Speak-With-One-Voice" imperative. Supporting the field is our highest priority as a training base; supporting the warfighter is our highest priority as a branch. So let us hear from you—fill our rucksack with your ideas and issues. Here are some ways our network will stay energized: (1) Semiannual Commandant's VTC (2d and 4th quarters)—make sure you're on the net, and contact us if you were not notified for the 30 January VTC; (2) Annual Engineer Senior Leaders Conference—ENFORCE 2001 "Engineers Leading Transformation" will be conducted here from 8 to 11 May; we're looking forward to seeing you; (3) Semiannual Engineer Council of Colonels (1st and 3d quarters)—offsets the VTC; the next one is scheduled for 8 May during ENFORCE; (4) USAES Web site—check us out and tap in; see info on how to do just that in this bulletin (page 47); (5) Army Engineer Association (AEA)—use this great organization to stay in the loop on goings-on throughout the Corps; and (6) *Engineer*—help us make this bulletin speak for and to you; we welcome your input on how to make it better. With all these media, we hope you have ample opportunity to be heard; if not, your calls, cards, letters, and e-mails are always appreciated and encouraged.

We will keep the network energized to keep you informed so that you know our "One-Voice" positions and can promulgate them. Remember, challenge them back to us, and advocate them with your bosses. Be steady, positive warriors; remain linked arm-in-arm with us in the professional development of our NCO and officer leaders. Commanders in the field, always take the time and effort to counsel and mentor your junior leaders so that they understand the vibrancy of their branch, appreciate their tremendous career opportunities, and maintain confidence in their leaders.

I want to welcome CSM Rob Robinson to the position of Engineer Regimental Command Sergeant Major and thank CSM Art Laughlin for his distinguished service. We also want to thank CSM Bob Dils for his great service here as the MANSCEN CSM and congratulate him on his selection to be the USACE CSM. Finally, our thanks go to LTG Bob Flowers on leaving behind such a superb organization in MANSCEN, building a great team at the Engineer School, and brilliantly leading our Regiment for the past 3 years. I know the entire Corps joins me to wish him well in his tenure as Chief of Engineers.

Essayons!

"...the power and genius of our branch has always been its people...."

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

As the new Command Sergeant Major of the Engineer School and the Regiment, I send my sincerest appreciation to the senior leaders of the Regiment for your vote of confidence that led to my selection. It means a lot to me to know that you all have faith in my abilities to perform these important duties. I pledge that I will always do my best to champion those issues and concerns you feel are vital to the future success of the Regiment.

I congratulate CSM Art Laughlin on his stellar career as he heads into life after the Army. I know you join me in saying to him from the Regiment, "Thanks for a job well done."

As I assume my duties as the Engineer School CSM, I have become painfully aware of the many projects, issues, and initiatives that our Engineer School is working and has been working for some time. The list is long, and the personnel available to work these issues are few. In the short time I have been at Fort Leonard Wood, I can tell you that I have gained a new respect for what our school does and the amount of work associated with improving our branch's relevance to the rest of the Army. It is a daunting task to say the least. BG Johnson has put together a quality team, and although few in numbers, the right people are here and doing their level best to help shape the Regiment, with respect to Transformation.

I have thought long about what I consider the important issues I need to focus on during my tenure as the Regimental CSM. I have formed this list based on my most recent challenges as the CSM of the 555th Combat Engineer Group: Transformation; guidance from my boss, BG Johnson; and from what I consider the most important element in our branch and Army—SOLDIERS. I intend to focus on the following areas:

Leader Development
- Engineer NCOES and Drill Sergeant School
- Sapper Leader Course

Soldier Development
- Engineer OSUT and AIT
- IET process
- Mental toughness in new soldiers
- Soldier retention

Training Development
- MOS qualification
- MOS consolidation
- POI revisions

To accomplish the above, I need to visit units and soldiers, all over the world, in the Active and Reserve Components. I need your insights and, specifically, trends you see, both good and bad, that need to be addressed. I know you all are very proud of your units and will put a lot of effort in telling me about them. I would prefer that you SHOW ME your units. I ask that you give me your candid opinions and time with your soldiers. I need to see them do what they do day-to-day. I don't necessarily want canned briefs, tours through barracks, or soldiers standing by. I do want to see them in the motorpools; in the field; up to their knees in mud; and at the ranges, training areas, and CTCs.

We have made great strides in team building among the senior leaders of the Regiment. We need to continue that, and the way we do that is by communicating with each other and attending ENFORCE and our other scheduled conferences. These are important to our Regiment and are key to addressing and fixing the issues we're faced with as a branch. I know we're busy and resources are tight, but we need to make the time and convince our commanders to make the resources available to attend these events.

The last key element in our branch's success is to "Speak With One Voice." We have been hearing that phrase since LTG Ballard coined it in 1992, but it's very important to our relevance as a part of the Objective Force. Speaking with one voice is the bridge between doing what we do at the Engineer School and what we do in units around the world. Speaking with one voice enables BG Johnson in winning the hearts and minds of our senior Army leadership and, more important, getting the resources we need to keep the Regiment relevant. It's what's going to perpetuate our existence as a force multiplier in the decade to come. And, if you don't know what you should be saying, call us or get on our home page to find out how you can help us help the Regiment.

I will close by telling you all that I am honored to be your Regimental Command Sergeant Major. I have done many things in my 28-year career that have given me great pride and a sense of fulfillment, but none more so than serving in this position. I will work diligently with BG Johnson and the other very important people at the Engineer School. I look forward to the challenges and working with you all.

Essayons!

"...show me your units."

Mine Threats in Mission Areas

By Colonel Andrzej Zarczynski

Mines are a very effective means of battle in international armed conflicts. The Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons–Protocol II, signed in 1980 in Geneva, Switzerland, bans the use of undetectable mines, booby traps, and other such devices, as well as the use of mines against the civilian population.

There are about 700 kinds of mines in the world, with about 300 of them being antipersonnel mines. Mines are often called "weapons of the poor" because most of them are simply constructed, inexpensive, simple to use, and very dangerous. Mines are used on a massive and uncontrolled scale—minefields are laid without plans, forms, or sketches in local armed conflicts. This weapon is always a threat to people, even after a war has ended.

The Problem

According to reports by the UN and nongovernmental organizations, about 35 countries produce mines. At present, about 110 million mines are laid in 64 to 69 countries, and each month, about 800 people around the globe are killed and 1,200 maimed by these mines. Some 300,000 people are living with shattered limbs and lives—and their number is still growing. Statistically, a new tragedy takes place every 20 minutes.

In Afghanistan, the most land-mined area of the world, there are probably 10 million mines. There are about 9 million mines in Angola; 7 million in Cambodia (left over from 25 wars); 6 million in the former Yugoslavia (Bosnia, Herzegovina, and Croatia); 2 million in Mozambique; and 1 million each in Somalia, Kuwait, Nicaragua, and West Sahara. There are also extensive minefields in Egypt and Libya that were laid during World War II.

Who laid these minefields? Probably everyone in a conflict area. For example, UN specialists estimate that in the former Yugoslavia, the laying of mines has gone through three distinctive phases:

The first phase involved demolition and laying minefields by the Yugoslav National Army (JNA) and the local civilian militia. Even if the regular army made partial records (such as maps, sketches, and forms) of the minefields, most of the mines laid by the militia were random and poorly recorded.

In the second phase (stabilization operations), intervention by the JNA brought some control over the mine warfare in the areas it controlled. Both sides brought some discipline to the mining practices and said that they established control only over the mines of the former Yugoslavia. Both sides agreed on clearing the mines to their rear areas so that only minefields in the front line would be left for protection of the units. In the same phase, civilians who were fleeing for their lives laid antipersonnel and antitank mines and booby traps in their homes, farms, fields, and forests.

In the third phase (ethnic and regional conflict), conflicting sides and civilians have continued to lay minefields randomly, with apparently no records made of their locations. Laid along roads and in forests, urban areas, and single houses, the minefields close convenient lines of activity.

In addition to the land-mine threat, unexploded ordnance (UXO) is also a problem. For example, during the civil unrest in Albania in March 1997, 38 storage buildings—containing about 5,700 tons of weapons, ammunition, mines, and TNT—exploded. (The explosions may have been caused accidentally by people who were searching for explosives or using unsafe electric lights.) Although some of the ammunition exploded completely, most of it was UXO and was delivered to 15 sites or "hot spots" that cover about 200,000 square meters. The sites are located in cornfields, on main roads that link villages, in forests, and near civilian houses. Local people, especially children, still perish as a result of both the explosions in those areas and the subsequent civilian handling of the UXO. So far, there have been 42 casualties and 59 wounded in Albania.

Mines

There are both antipersonnel and antitank mines in the conflict areas. These mines may be laid singly, in groups, and/or as minefields. Sometimes they are laid using an unconventional method (for greater effectiveness) and specially constructed booby traps. Following are examples of laying antipersonnel mines unconventionally:

- Using two fragmentation mines connected by one trip wire.
- Using a fragmentation mine with six wires extending from it. When one of the wires is touched, the mine explodes.
- Using a device which, when broken, completes a firing circuit. What appears to be a grey plastic box is attached to a fragmentation mine and, when the trip wire is cut, it completes the circuit and the mine detonates.

Following are examples of laying antitank mines unconventionally:

- Painting over the training markings on training mines. These would then be deployed in a group, with only one real mine in the group.

A minefield laid in Serb Krania, Croatia

- Turning a mine upside down with an antihandling device (AHD) in it. The mine could detonate when it is lifted.
- Piling mines to enhance an explosion. (An antitank mine could be combined with 15 to16 kilograms of explosives.)
- Laying an antitank mine as an antipersonnel mine. The mine is buried in a sand shoulder, and a trip wire linked to the top of the fuse is attached to a tree opposite the mine.

Booby Traps

Booby traps are a common means of protecting property. They are laid by both troops and civilians. (Both sides in armed conflicts deny using these devices but always accuse their opponent of using them.) The construction of the mines depends on the inventiveness of the people who construct them. In

Unexploded ordnance in Albania

booby traps, common-user items and military equipment (such as weapons and bayonets) are usually used. Following are examples of booby traps used in conflict areas:

- A fragmentation mine placed with two tight trip wires on both sides of the mine, going in the same direction. One end of the wire is attached to a tree trunk and the other end to a bent branch. If the wire leading to the trunk is cut, the mine explodes.
- A bounding mine attached to stakes at the height of about 1 meter. A wire under the ground attaches to 5 kilograms of TNT with a pull fuse.
- A grenade in a glass, which is attached to a door or window handle. When the door or window is opened, the device falls out of the glass and detonates.
- A video, record, or stereo booby-trapped, since these are attractive loot items.
- A glass setting on a small hole drilled in a tabletop. One end of a fishing line is glued to the bottom of the glass, and the other end is threaded through the hole and connected to an initiator (with an explosive or a grenade) below. Moving the glass sets off the trap.
- A propane bottle loaded with explosives and filled with gas. One such bottle was exploded on a road, causing a crater that was 2.5 meters deep and 7 meters wide.
- A dropped pen containing explosives. Children often pick them up and lose a hand as a result.

Mine Clearing

Mines are the main threat to missions (UN and NATO), troops, and clearing teams. Mine clearance is not only costly and slow but also extremely dangerous. After the war in the Falklands–Malvines (a war that lasted only 2 months and was waged between two conventional armies), mine-clearing operations were begun at once. However, the operations were so difficult that they were finally abandoned. Think what the situation must be in countries where fighting has continued for years and mines have been used indiscriminately and on a massive scale?

For example, during mine-clearing operations in Bosnia-Herzegovina, the mine-field records were checked. Some were of good quality, with the recorded intervals between mines, the distance between rows and marking points, and the direction and distance of marking points relatively reliable. However, in other records, the amounts and types of mines did not match those actually laid in the land, the marking points were not given, and they were indistinguishable from the terrain.

Since the beginning of the Implementation Force (IFOR)/ Stabilization Force (SFOR) mission in Bosnia, there have been at least 10 casualties and 70 wounded as a result of mine explosions, and each month there are a few more. If clearing operations in this area proceed at the current rate, it will be 230 years before the last weapon is removed.

In Afghanistan, a country infested with mines, the UN Office for the Coordination of Humanitarian and Economic Aid to Afghanistan (UNOCHA) has launched a mine-clearing program. With the 27 mine-clearing teams now operating, it will take at least 15 years to clear the priority zones! At a rate of 30 square kilometers per year, it will take more than 4 years to clear mines manually from only 20 percent of the Afghan territory. Sixteen UNOCHA staff members have already been killed and 20 injured while removing mines from only 68 square kilometers of territory.

In Kuwait, as many as 84 foreign and local experts were killed by mines in less than 10 months.

And in the former Yugoslavia, many mine incidents have occurred despite special training and prevention efforts. Between April 1992 and December 1995, there were 22 casualties and 217 wounded in the United Nations Protection Force (UNPROFOR) as a result of mine explosions. Of those incidents, 114 were due to antipersonnel mines, 82 due to antitank mines, and 19 due to booby traps. There were 112 vehicles lost or damaged and 72 incidents of people stepping on mines and losing a foot. In addition, there were 41 French, 38 British, 29 Canadian, 18 Ukrainian, 13 Danish, 13 Russian, and 10 Polish casualties.

Executing tasks under the threat of mines in mission areas is very difficult. You must never abandon your observation post or checkpoint or change your route because you will be in great danger. The table on page 7 shows the various causes of mine incidents.

Clearing mines in Serb Krania, Croatia

Cause of Incidents	Percentage of Incidents
Walking in unsafe areas	31.53
Performing mine-clearing operations	16.32
Encountering mines laid in previously cleared areas	14.11
Traveling in vehicles in unapproved areas	13.01
Traveling in vehicles on road shoulders	9.81
Encountering booby traps	8.71
Becoming lost	6.51

Conclusions

The dramatic mine situation in conflict areas indicates that the following problems remain to be solved:

- After international armed conflicts, all minefields should be marked (to include fencing) as a part of demobilization, and steps should be taken to provide for the safety of the local population.
- As mines often are not equipped with neutralizing or self-destruction mechanisms, conflicting sides need to disseminate all minefield information as soon as possible after a war.
- Mines are being produced that are virtually impossible to detect; therefore, the locations and characteristics of all minefields should be recorded.
- Clearing minefields is a long, costly, and dangerous task, but it needs to be done as soon as possible by those who have the means.
- In international armed conflicts, rules outlined in Protocol II of the 1980 United Nations Convention must be obeyed.

While the cost of laying one mine is only a few dollars, and laying a minefield is perhaps several hundred, clearing unexploded mines is very expensive. And the cost of treating surviving mine victims and preparing them to live in society (if this is at all possible) is still more.

Although the following cautions seem obvious, they cannot be stated too often:

- Do not drive past mine signs; they are there to alert you to danger.
- Do not ignore local advice.
- Listen to the advice of engineers.
- Avoid tracks that have not been used for some time.
- Stay within the known safe areas.
- Do not attempt to breach a roadblock.

The mine threat is real, and we must respect this threat. Mines kill!!

Colonel Zarczynski, an officer in the Polish armed forces, is the head of the Tactics Department of the Engineering Training Center, Tadeusz Kosciuszko Military Academy, Wroclaw, Poland. He has served in the UNEF mission in Sinai, the UNPROFOR mission in Croatia, and the ASIDT in Albania. He is currently training the Polish engineering units for UN and NATO missions.

References

(English titles)

1. "A Perverse Use of Technology Mines," International Committee of The Red Cross, 1992.

2. *Post Operation Report of NATO PfP Support to Albania*, 5 October - 4 December 1998.

3. Albanian General Staff - Ammunition Branch, Briefing of the Albanian Experts, *Tirana* 6.10.1998.

4. *UNPF Mine Incident Report*, December 1995.

5. *Landmine, Mine Action News*, The United Nations, Volume 3.2, Fourth Quarter, 1998.

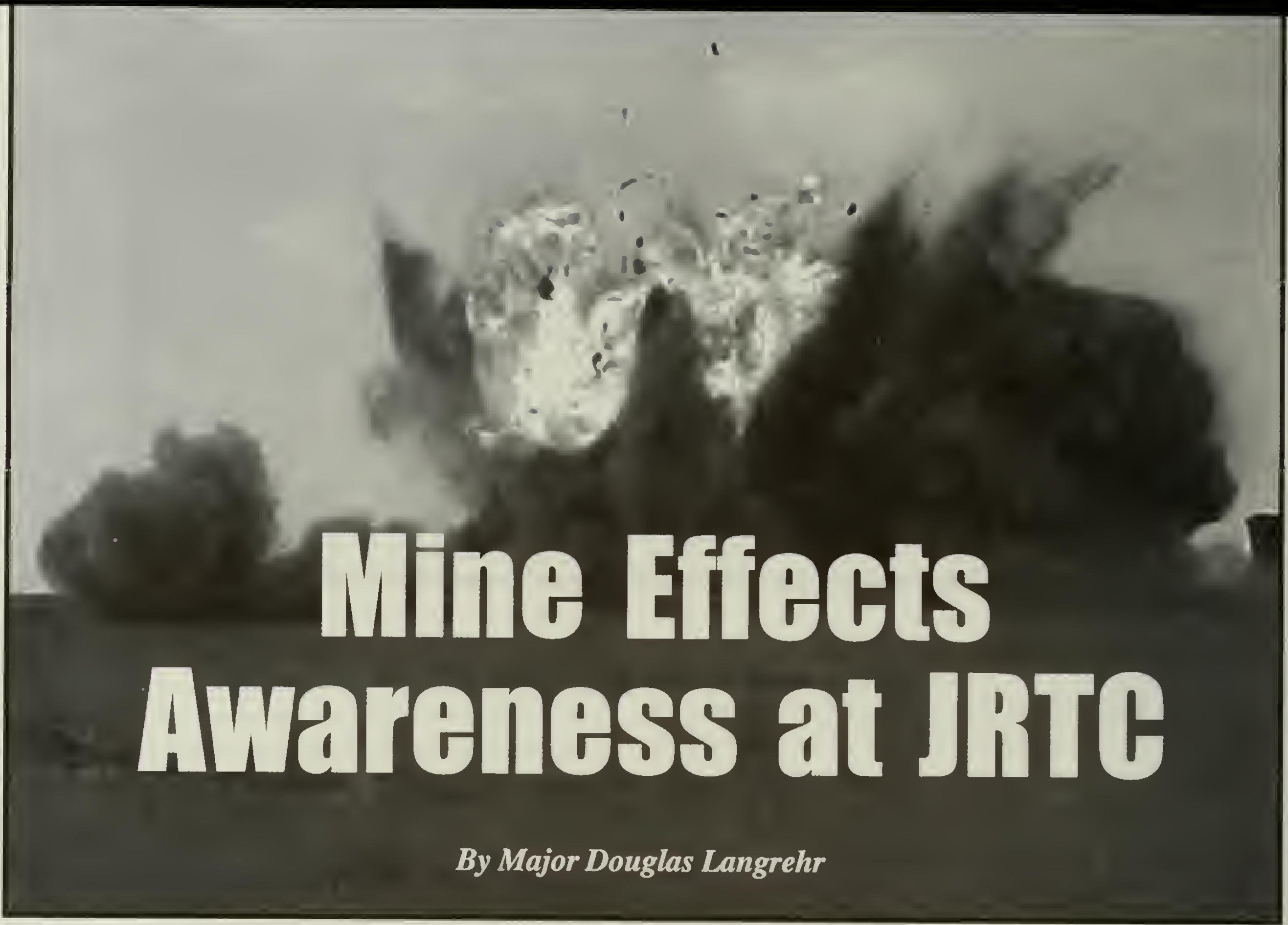
6. Barry, John. "It's Not a Pretty Picture," *Newsweek*, March 8, 1999.

7. Dickey, Christopher. "Seeds of Carnage," *Newsweek*, August 2, 1999.

(Polish titles)

1. Zuchowski Ryszard. "O minach przeciwpiechotnych," *PWL* 4/1998.

2. Romanowska Krystyna. "Pola nienawisci," *Zycie* 4.8.1999.



Mine Effects Awareness at JRTC

By Major Douglas Langrehr

The spectators sweltered in the hot midmorning sun on the June 2000 day. It must have been over 100 degrees and as humid as a sauna. We stood behind a fence made of white engineer tape, staring at the distant targets that shimmered in the heat. The kevlar helmets we wore added to the discomfort, and the soldiers fidgeted, waiting in anticipation while the demolition experts attached the remote firing device to complete the preparation. As the captain gave the order to fire, everyone watched in awe as a Soviet TM-62 mine was detonated under the track of a 54-ton combat-engineer vehicle (CEV).

The flash and immense cloud of smoke and dust brought gasps of surprise from the crowd as the tank was physically picked up and moved like a child's toy. Next came the unmistakable "whomp" of detonating high explosives, followed by whining sounds as shards of shattered armor went flying through the air. Silence. "Dear God," muttered a sergeant. "I think we have been underplaying the effect of mines here at the Joint Readiness Training Center (JRTC)."

And so the aim of the first engineer mine-demolition practice at the JRTC was achieved. The intent of the senior engineer observer/controller (O/C) was to demonstrate the devastating effects of a selected range of Soviet and U.S. mines on a variety of vehicles. In addition to increasing the awareness of the O/Cs and capturing the display on video, we hope that the demonstration will encourage commanders to develop route-clearance and security plans and take the mine threat seriously in all future operations.

The Targets

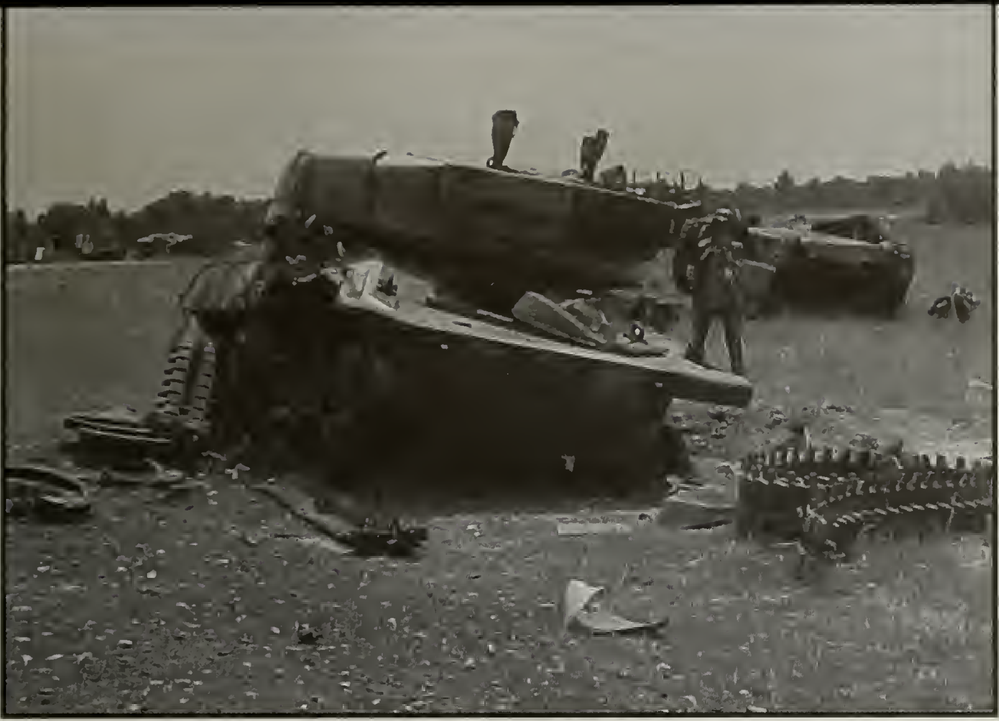
The engineer team came up with an impressive display of working and hulk vehicles for targets for the demonstration: a working CEV, two Sheridan tanks, two M113 armored personnel carriers (APCs), a working jeep, and a 2.5-ton truck. And the Army and Air Force Exchange Service donated a mannequin to help demonstrate the effects of an antipersonnel mine.

The Mines

We sought assistance from the U.S. Army Communications-Electronics Command's Countermine Division, Fort Belvoir, Virginia, to provide the land mines to be used in the demon-stration. The agency sent a team with mines, explosives, and the expertise needed to make the demonstration a success. The mines included an Italian VS-50 antipersonnel mine; Soviet TM-62 antitank mines; U.S. M15 and M19 blast mines and M21 shaped-charge mines; as well as 1-, 10-, and 15-pound satchel charges. The team also brought a comprehensive display of the types of mines U.S. forces could encounter worldwide.

The Setup

The engineer team selected sites for each target to ensure that the audience would gain the best view of the practice. The vehicles were positioned and the mines were laid out in preparation for placement. The team wanted to ensure that the type of fuze, the location of the mine, how it



Sheridan tanks destroyed by a TM-62 (left) and an M21 (right)

was buried, and even the type of spoil that went on top of the mine were commensurate with the type of mine being used. The team also placed the mines so the JRTC video team could get the best angles for filming.

The video team consisted of four professional crews with eight video cameras. Four cameras were housed only 100 meters away from the targets in specially made protective boxes. The remaining cameras were placed around the targets, just outside the safety distance. At the end of the day, all mines were in place, the camera plan was perfected, and the range was ready to go.

The Practice

The busses arrived and the safety brief was given. The spectators inspected the targets and then moved back to the viewing area. For the next 2 hours, the mines and charges were detonated with a break in between to allow the spectators to view the results. Between each serial, a narrative was provided on the history of mine warfare.

A jeep destroyed by a TM-62

The blast mines shattered tracks, destroyed suspension components, and buckled hulls. The shaped-charge mines penetrated the hulls and destroyed engine blocks. One of the APCs was picked up and thrown onto its side, and the other flipped onto its top. The wheeled vehicles were totally destroyed.

The Conclusions

The aim of the mine-awareness demonstration was met—with some additional benefits. The video will be made available to all rotations that come through the JRTC and to the branch schools. Although the videos cannot show the psychological and physical effects of mines on humans, they should help soldiers understand the devastating effects of mines on equipment. The engineer team at the JRTC hopes that this demonstration and video will prove the need for mine-awareness training at the unit level.

Major Langrehr is the deputy senior engineer observer/controller at the Joint Readiness Training Center, Fort Polk, Louisiana. He joined the Australian Army in 1986 and graduated to the Royal Australian Engineers in July 1987. MAJ Langrehr has had command as a lieutenant and captain and commanded the1st Field Squadron as a major. He is a graduate of the Australian Staff College.

Units can request the video through MAJ Langrehr at *Douglas.Langrehr@polk-emh.army.mil.*

Ambush at Serzhen Yurt:

Command-Detonated Mines in the Second Chechen War

By Captain Adam Geibel

> ***Our task is to find the bandits and destroy them. A special operation is now going on in the Vedeno and Shatoi gorges to destroy bandits.***
>
> ***Colonel-General Gennady Troshev***
> ***Commander of federal troops in the North Caucasus***
> ***22 April 2000***

The Second Chechen War began in September 1999, when Russian forces crossed into Chechnya intent on crushing several armed groups that had attempted to create an Islamic uprising in Dagestan. The Russians quickly pushed Chechen units from the plains and laid siege to the capital, Grozny. After the city fell in February 2000, the remaining Chechen units exfiltrated into the country's southern mountains.

From their hideouts, the Chechens resorted to ambush tactics they had perfected during the First Chechen War (1994 to 1996). Using the best intelligence available, a terrain-favorable ambush site was picked and command-detonated mines were laid. When the Russian unit entered the kill zone, the result was predictable—the Chechens destroyed vehicles and killed Russian troops, then slipped away almost unscathed.

A February formal announcement that federal troops had crushed the backbone of Chechen resistance and were giving up large-scale operations was cast into serious doubt by three well-planned and costly Chechen attacks that month. OMON (special-purpose police detachments),[1] Spetsnaz, and airborne units were all hit hard, with command, control, and coordination problems later cited as the reason for heavy federal casualties. Yet complacency remained in the federal command. Despite late-March Russian estimates that 4,000 Chechen fighters were still operating in the southern Chechen mountains and that 1,000 more had escaped to the plains to blend in with the local population, Federal Interior Ministry unit commanders continued to be careless and failed to coordinate operations with the army.

On 2 March, a 98-man, Moscow-area OMON unit, traveling in nine Ural soft-topped trucks, was ambushed in Grozny. The Chechens had chosen a site at the entrance to the rubble-strewn Staropromyslovsky district where the road rises. There were no BRDM scout vehicles or BTR armored personnel carriers escorting the OMON, and the only armor protection the officers had were flak vests hanging on the sides of the vehicles. Reports gave varying casualty figures of 20 to 37 killed and 12 to 17 wounded. Most of the trucks were destroyed or damaged.

On the evening of 5 April, a Nizhnevartovskiy OMON unit bringing replacements from the Khankala air base was hit on the road to Kurchaloy. A command-detonated mine was blown under the lead vehicle, a BTR,[2] and only a large-caliber antiaircraft machine gun mounted on one of the UAZ jeeps kept the convoy from being overrun. The Russians admitted to one killed and eight wounded.

The Ambush

The military launched "a planned mop-up[3] of mountain areas" in mid-April, but sources in the Russian headquarters claimed that the federal command had somewhat bigger plans and estimated that about 3,000 troops were involved in the area. An airdrop was made south of Shatoi on 18 April, and Russian paratroopers went on search-and-destroy missions to eliminate small Chechen groups (and their bases) that had not been forewarned.

Probably due more to necessity than the operational luxury of a carefully chosen target, the Chechens targeted a rear (services) column of the 51st Parachute Regiment, 106th (Tula) Airborne Division, for their classic command-detonated-mine ambush. According to the Russian defense minister, at 1730 Moscow time on 23 April, a convoy carrying ammunition and other supplies to the airborne unit was ambushed 3 kilometers south of Serzhen Yurt. This area is about 25 kilometers/16 miles southeast of Grozny, in the Vedeno Gorge, and close enough to the mouth of this terrain feature to be considered a "covering position."

The Chechen Version

The "Jihad in Chechnya" Web site reported that field commander Abul Waleed Al-Kindi's unit was on a reconnaissance mission when it detected the moving 23-vehicle Russian armored column on the road from Serzhen Yurt to Vedeno. Abul Waleed's unit was joined by field commander Abu Ja'far Al-Yemeni's unit [4] (which had been stationed near the Serzhen Yurt-Vedeno road for more than 4 days), and both hastened to set up an ambush. According to one source, there were 75 mujahideen of the Islamic Peacekeeping Army and Spetsnaz units of the Central Front (5 Arabs, 11 Dagestanis, 4 Ingushs, 5 Karachayans, and 50 Chechens).

The Chechens triggered the ambush and, in less than an hour, claimed that they had "turned all 23 vehicles into masses of burning hulls and twisted metal." The French wire service *AFP* quoted a Chechen spokesman who said that a 4-hour battle erupted after a Russian column of 23 "tanks" was ambushed at 1500 hours in Serzhen Yurt. *AFP* originally reported that 18 tanks were knocked out and 80 Russians killed, while 5 tanks escaped. *Reuters* quoted the spokesman as saying that "the armored column was totally destroyed," with 13 tanks

Typical OMON transport (note fuel drum)

MT-LBs replace BTRs as convoy escorts in the mountains. Unpaved roads were easy to mine.

and troop carriers knocked out. However, there were conflicting figures on the Chechen side. The next day, Chechen fighters in Ingushetia told *The Associated Press* that 9 of 23 vehicles in the column were damaged after 40 minutes of fighting.

Initially, *Qoqaz* reported that 10 armored fighting vehicles were destroyed in the attack but that there was no specific count of enemy casualties (although they felt that there were very heavy losses amongst the Russian ranks). A later report from the same news Web site listed 10 trucks, 4 BMP infantry fighting vehicles, a Shilka (a self-propelled antiaircraft gun) vehicle, and several other Russian military vehicles destroyed, along with 56 Russian soldiers killed. The Chechen spokesman claimed that no prisoners were taken and that there were no losses on the Chechen side.

The Russian Version

As far as the Russian army was concerned, all necessary and possible protective measures had been instituted. The convoy left Khankala at 1400 hours, and the 106th Airborne deputy division commander told the press that "ahead of the airborne troops' rear convoy, two combat convoys had taken the same road. Evidently the gunmen deliberately let them pass, waiting for the vehicles carrying stocks of fuel and ammunition. They thought they would be easy prey."

Russian NTV quoted the commander of the joint group of forces as saying that the 22 vehicles had a two-vehicle combat reconnaissance patrol—a BMD air-droppable combat vehicle and a BTR with a sapper unit on board—at the head of the convoy. The convoy's main body was led by another BMD, as part of its five-vehicle protection force. The Russian Military News Agency (AVN) listed four BMDs and a Shilka (not a ZSU-23-4, but a 23-millimeter ZU-23-2 on a Kamov truck) at the rear of the convoy.

There were "more than a pair" of combat helicopters escorting the convoy, which was also within range of and directly supported by artillery. As a rule, helicopters operate as part of an aviation tactical group (2 to 4 Mi-24 gunships and 1 to 2 Mi-8 transports, each with 20 Spetsnaz troopers aboard), usually attached to a regiment. The route had been reconnoitered in advance, and the convoy was able to maintain radio communications.

The mujahideen had hidden on the back slopes of two dominant heights so that they remained unnoticed "until the beginning of their assault" despite the helicopter escorts hovering above (probably because of the long shadows, as it was late in the day). *Interfax* noted that the Chechens attacked the column with 15 radio-controlled mines[5] and sniper fire, along with a volley from grenade launchers and firearms. The mujahideen said that they got as close as 15 to 20 meters to the Russian tanks and BMPs. A fueler and five ammunition-laden trucks were destroyed.

Both sides stated that the attackers were driven back when federal helicopters rocketed the area. Only the second pair of helicopters managed to detect the Chechen firing points and opened fire at 1740 hours. Since the Chechens apparently were within 60 meters of the column, supporting artillery initially couldn't react for fear of hitting the paratroopers. The Russian

> "While there are many ways to create command-detonated mines, *how* they are employed determines their repercussions."

publication *Isvestia* reported that the helicopters' air strike on the outskirts of Serzhen Yurt was inflicted after 1800 hours—after the battle was already over.

Additional Russian troops (including airborne reconnaissance companies) surrounded the ambush area at 1805 and fighting lasted until 1930—when the attackers scattered (according to the Russians, towards the village of Marzoi-Mokhk). Udugov added that a Russian counterattack had left the village burned-out—even though Chechen fighters had left the area—while *Qoqaz* noted that the two mujahideen units returned to their bases laden with a significant quantity of captured arms.

The Aftermath

Russia's top spokesman on Chechnya, Sergei Yastrzhembskiy, had a slightly different version of the battle-damage assessment than his Chechen counterpart. He said that between 50 and 60 Chechens attacked the convoy near the village and initially reported eight rebels killed and two taken prisoner. He later said that 20 were killed and 14 captured. (The Russian Airborne Troops headquarters said that 20 Chechens were killed and 2 taken prisoner.)

General Troshev estimated that 80 to 100 "bandits" attacked from both sides, along the entire length of the convoy. A spokesman at the unified federal headquarters in the North Caucasus admitted that five federal troops were killed and nine wounded and a truck and a fueler were damaged. The Russian defense minister raised this to 15 government soldiers killed and 6 vehicles damaged, including the fueler.

On 24 April, Yastrzhembskiy admitted to 15 Chechens killed and 6 wounded. *AVN*'s final tally was 13 killed, but this climbed to 17 by 26 April. However, the news Web site *gazeta.ru* reported that up to 25 had been killed. General Troshev told the press that the bodies of 4 fighters were found and 11 prisoners taken in the area (but he could not say whether all of them were bandits, although his most current information indicated that).

The most significant Russian reaction came from the commander of the group of federal troops, who concluded that in order to prevent such incidents, the movement of rear convoys through Chechnya's territory should be substantially reduced. He also stated that in most cases, transport helicopters should be used to deliver material resources and ammunition to subunits stationed in mountain and foothill regions of the republic.

Thoughts for the Future

The Chechen units used classic guerrilla tactics to their best effect. Relying on good intelligence (including radio intercepts), they supported their command-detonated mines with direct-fire antitank and automatic weapons. Where possible, there was also mortar support.

The majority of command-detonated mines have been labeled "radio-controlled" in the Russian press, but there have been few technical details. During the First Chechen War, criminals in St. Petersburg were arrested for manufacturing such devices from remote controls of automobile alarms and explosives scavenged from World War II German ordnance found outside the city. The Russians have mentioned that the standard mine used for antitank attacks was the TM57, while antipersonnel mines were usually 152-millimeter, high-explosive shells with "several" slabs of plastic explosives packed around them.

While there are many ways to create command-detonated mines, *how* they are employed determines their repercussions. A rucksack full of explosives and a simple detonator, combined with skillful exploitation of an enemy's weaknesses, can become a tactical weapon that achieves strategic results. The Old Testament story of young David's pebble shot taking out the giant Goliath applies here. This was particularly true during the First Chechen War, when several senior-ranking Russian officers insisted on keeping set patterns and traveling along the same routes at predictable times. They paid for this mistake with their lives.

The Chechens chose their ambush sites carefully, making maximum use of dominant terrain, which placed them so close to the targeted unit that Russian helicopter gunships were frustrated. The Chechens also found the "seam" in the Russian phalanx —the coordination, control, and command nightmare that exists between the Russian army and the Interior Ministry.

The Relevance for Combat Engineers

American units' most recent experience with command-detonated mines was in Somalia. Pure luck has been the only thing preventing further incidents in Bosnia or Kosovo and, chances are, American forces will face this type of weapon and attack in the future.

While acting independently, American forces have standard operating procedures to deal with such ambushes. The danger lies in coalition-type peacekeeping forces, where any opposition will seek to find and attack the weakest link in the force. These weak spots could range from language barriers and differences in levels or types of training to the degree of equipment modernization. It could be especially dangerous when military units have to work with police forces.

If American forces—specifically combat-engineer squads—are cross-attached to new allies, they need to review individual skills such as call for fire, map reading, and encoding grid coordinates (imagine if the allied force doesn't have the Single-Channel, Ground-to-Air Radio System [SINCGARS]). However, the best way to counter command-detonated-mine ambushes is through superior command-and-control coordination. This means that combat-engineer leaders need to know their hosts' plan and proactively ensure that everyone associated with the attached engineer group knows *their* plan. In short, make sure that the left hands know what the right hands are doing.

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All photos from Venik's "War in Chechnya" Web site.

Endnotes:

[1] The OMON, or "Omonovtsy," have been described as a secretive paramilitary force with a reputation for brutality. Part cop, part commando, a bit like a BATF raid team with some training like U.S. Army Rangers, there simply is no real equivalent to the OMON in the U.S. military or law-enforcement communities.

[2] A BTR is frequently called a "bicycle" by the troops, since they consider it to be equivalently armored and could only be called "serious protection" by a person who has never seen one.

[3] When mobilized for combat zones, the OMON are tasked with some of the war's dirtiest work—mopping up (known as "zachistki") Chechen villages and urban areas of stay-behind mujahideen, which means flushing them out of hiding places and/or separating them from the civilian population.

[4] The Russian military spellings are Abu-Valid (one of Shamil Basayev's lieutenants) and Abu-Dzhafar (adding that both were Arabs, with the fighters being "Arab and Pakistani mercenaries").

[5] "Fougasses" was the specific term used by *Nezavisimaya Gazeta's* Ilya Maksakov.

References

1. "Georgiyev: Growing Value of Army Aviation, Particularly the Use of Strike Helicopters in Chechnya," *Nezavisimoye Voyennoye Obozreniye*, No. 4, 4-10 February 2000.

2. "Feds Airdrop 3,000 Men South of Chechnya's Shatoi," *AVN*, 18 April 2000.

3. "Federal Troops Continue to Fulfill Duties in Chechnya," *ITAR-TASS*, 23 April 2000 .

4. "80 Russians Killed in Chechnya Ambush: Rebels," *AFP*, 23 April 2000.

5. "Chechen Rebels Kill Russian Troops," Yuri Bagrov, *AP*, 24 April 2000.

6. "Rebels Attack Motorcade in Southern Chechnya, Five Feds KIA," *AVN*, 24 April 2000.

7. "Moscow Concedes Fresh Chechen Ambush in Southern Mountains, *AFP*, 24 March 2000.

8. "Russians Sustain Heavy Losses in New Ambush," *Qoqaz*, 24 April 2000.

9. "15 Troops Dead in 23 Apr Chechen Convoy Attack," *Interfax*, 24 April 2000.

10. "15 Paratroopers, 20 Rebels Killed in Chechnya," *RIA*, 24 April 2000.

11. "Yastrzhembskiy: 20 Chechen Rebels Killed in Convoy Attack," *Interfax*, 24 April 2000.

12. "Thirteen Russians Killed in Chechen Rebel Attack Sunday," Troshev, *Interfax*, 24 April 2000.

13. "Rebels Attack Motorcade in Southern Chechnya," *AVN*, 24 April 2000.

14. "Maskhadov's Ceasefire Was Short, Andrey Matyash," *gazeta.ru*, 24 April 2000.

15. "Russian Reinforcements Receive Their First Battering," *Qoqaz*, 24 April 2000.

16. "Shamil Basayev on the Operation in Serzhen Yurt," *Kavkaz Center*, 25 April 2000.

17. "Terrain Irregularity," *Izvestiya*, 25 April 2000.

18. "Paratroopers Have Died Again; Maskhadov Retracts His Statements," Ilya Maksakov, *Nezavisimaya Gazeta in Russian*, 25 April 2000.

19. "Shooting of Column-4 Helps Nothing in Chechnya," Olga Ruban, *Moskovskiy Komsomolets*, 25 April 2000, p.1.

20. "Details of Rebel Attack on Federal Convoy Made Public," Andrey Marychev, Pavel Koryashkin, *ITAR-TASS*, 25 April 2000.

21. "Russian Troops' Latest Victory Secured Almost Without Losses," Irina Paramonova in Tula and Aleksandr Igorev, *Kommersant*, 26 April 2000.

Personal Viewpoint

BEWARE

MINES DON'T CARE

Mine-Clearing/Demining Operations: Developing Engineer Experts

By Captain Darren LeMaster

I believe that we need to develop engineer experts in the U.S. Army who possess both the knowledge and the capability to perform mine-clearing operations. During the past four years, our engineer soldiers have operated in areas contaminated with minefields and unexploded ordnance (UXO)—in Bosnia-Herzegovina and more recently in Kosovo. Their greatest challenge is that they typically lack both clearing/demining training and demining equipment. I believe that we failed to utilize opportunities in Bosnia to train; evaluate; and establish tactics, techniques, and procedures (TTP) for new demining equipment. Additionally, U.S. engineers are ignorant of basic foreign mines and UXO render-safe procedures. With these limitations, it is essential that a staff engineer becomes knowledgeable about basic humanitarian demining fundamentals.

This article outlines the fundamental procedures of humanitarian demining operations as described in lessons from the French Army Engineer School, where I attended the Humanitarian Demining Course in Angers, France. The article also includes information from missions in Bosnia-Herzegovina and outlines some of the basic responsibilities of a properly structured demining operation.

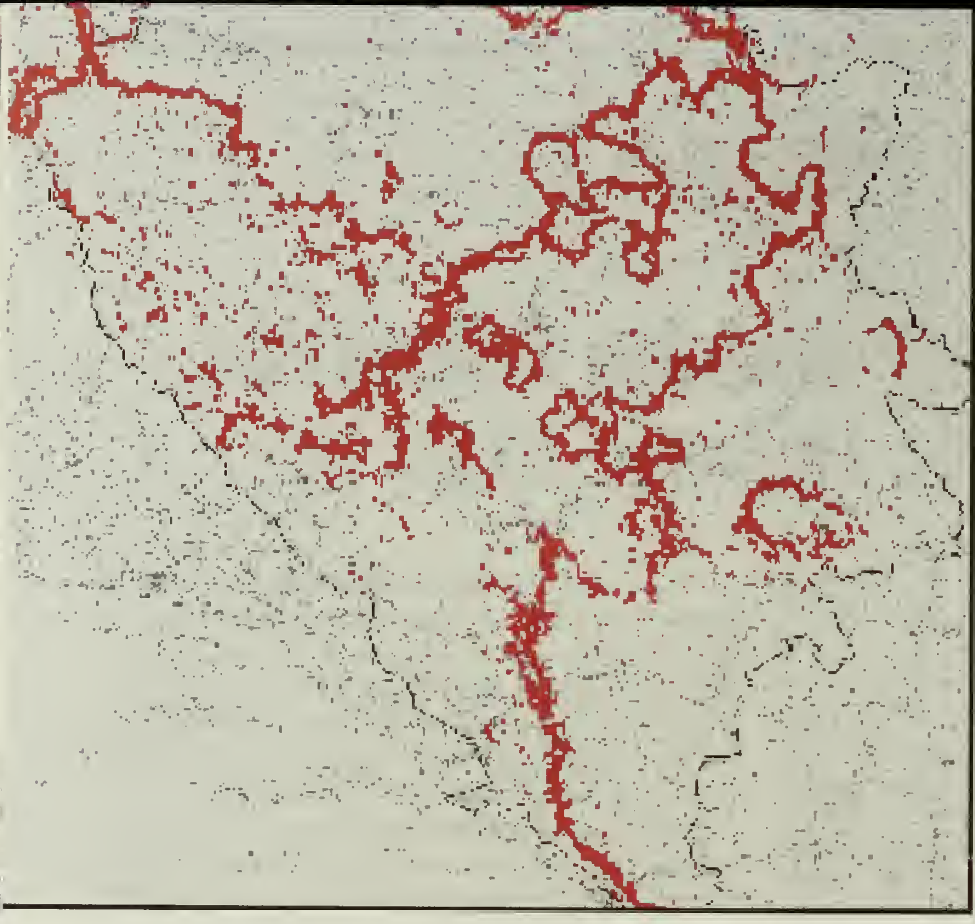
Clearing vs. Demining

FM 20-32, *Mine/Countermine Operations*, Chapter 9, differentiates between the terms "clearing" and "demining" by describing clearing as operations for a military purpose and demining as operations typically for a civilian population (humanitarian purpose) after hostilities cease. In FM 20-32, the terms are defined as follows:

> ***Clearing*** *involves the total elimination or neutralization of mines from an area. It is not usually conducted under enemy fire, but it can be conducted by engineers during war or after hostilities as part of nation assistance.*
>
> ***Demining*** *is the complete removal of all mines and UXO to safeguard the civilian population within a geopolitical boundary after hostilities cease. It is an extremely manpower- and time-intensive operation and is normally contracted. Although not a formal Army mission or function, engineers and Special Operations Forces may provide special expertise in training demining organizations, acting as advisors, and taking the lead in providing clearing equipment or techniques that can be useful in demining operations.*

Whether clearing/demining operations involve the military or nongovernmental organizations, the overall objective is the same—to remove contamination and provide a safe area. And whether monitoring mine-lifting activities, conducting mine-clearing or humanitarian demining operations, or identifying a piece of a cluster-bomb unit, the critical factor is to determine if an area is safe. When soldiers are questioned about the safeness of an area, their answers will vary significantly based on their knowledge of the basic principles and organization of demining operations—training, information collection and surveys, planning, the mission, and mine-awareness training programs.

This photo of a destroyed building depicts a typical sight from operations in Bosnia-Herzegovina.



A minefield-contamination map from the U.N. Mine Action Center shows the extent of the contamination.

Mine Experts

Who are the U.S. Army mine experts? The knowledge is spread throughout various Army specialties:

- Explosive-ordnance-disposal (EOD) personnel, the technical experts in identification, render-safe procedures, and destruction or neutralization of ammunition, land mines, submunitions, and pyrotechnics.
- Special Operations Forces, who are currently instructing humanitarian demining efforts in numerous countries and possess a language proficiency, rapport, and cadre training ability to do so.
- Engineers, who have the basic knowledge of mine detection, demolitions, minefield reduction or breaching, and technical and tactical employment of U.S. mines.

Most foreign armies, to include the French army, have a combined engineer/EOD specialty. The U.S. Army lacks this type of expertise. Because the EOD and Special Operations Forces communities are relatively small and have a distinctly different mission, engineers have been forced into assuming the lead role in UXO/clearing operations.

In my opinion, nongovernmental organizations are often best suited to demining operations because of their experience, training, and structure. However, I believe that we also need engineers who are experts in clearing operations and identifying UXO/mines. We need engineer staff NCOs or officers who can advise commanders during missions in and around contaminated areas. To develop such experts, training should include information on—

- Safe operational procedures (a fundamental knowledge of clearing operations).
- Proper demining equipment usage and techniques (TTP).
- Facilitation of a unit UXO/mine-awareness training program.
- Families and characteristics of mines, submunitions, and pyrotechnics.

It is important to understand how mines and UXO affect battlefield operations due to changing factors such as temperature, wind, vegetation, and trees. An understanding of humanitarian demining operations, such as those conducted in Bosnia-Herzegovina, is necessary for the safe execution of military operations. Regardless of the mission TTP produced at the Engineer School, a bottom-line and fundamental knowledge of demining operations, such as the French humanitarian demining training, is needed now at the unit level in order to modify TTP to site-specific mission factors and requirements. *The goal is not to train deminers but to provide a basic knowledge so that when mine-clearing operations are conducted or observed due to a military necessity, the missions are conducted safely.*

Demining Training

Numerous humanitarian demining training programs exist today, ranging from various nongovernmental-organization programs to the United Nations Humanitarian Demining Training Program. The programs are very similar with respect to the type of training; however, each program is adapted to fit the local area, the personnel trained, and the type of contamination.

The underlying goal in Bosnia-Herzegovina was to develop a national-level demining training program to provide deminers for the local areas. The core functions of a demining program are individual and leader training, preoperations procedures, minefield marking, and survey training. A professional training staff is necessary, in addition to a suitable place to conduct training that simulates the operational area. Additionally, self-discipline is an essential factor to consider during training because of the seriousness of failing to conduct clearing tasks properly.

Individual/Leader Training

The training conducted depends on the initial knowledge level of the personnel being trained. The French approach to individual demining training is divided into the following basic tasks:

- Mine and booby-trap procedures.
- Prodder, trip-wire, and mine-detector procedures.
- Marking procedures.
- Actions on encountering a mine.
- Demolitions training.
- Job responsibilities.

Preoperations training establishes a basic knowledge of how to conduct a specific clearing mission:

- Setting up a clearance worksite.
- Site operational procedures.
- Reporting procedures.
- Equipment checks (detector and personal-protection equipment).
- Actions in case of injury and medical-evacuation procedures.

Personnel who demonstrate proficiency and leadership skills during the training process become leaders for the demining teams. In addition to individual training, selected leaders learn leadership skills, site-reconnaissance procedures, and route- and area-clearance methods. Typically, leaders manage the operations of three 2-man teams. The employment of these teams depends on the terrain, types of mines, detection methods, contamination information, and knowledge of each of the deminers. Demining leaders manage the daily demining operations and must know the psychological limits and mental condition of the deminers.

Training in Bosnia

In 1997, as a part of the Stabilization Force initiative in Bosnia-Herzegovina, the 16th Engineer Battalion's Task Force Catamount set up a program to train local Bosnian military deminers on humanitarian demining techniques. Based on the United Nations Humanitarian Demining Training Program and some aspects of other programs, the initiative focused on the local mines and incorporated the knowledge level of deminers participating in the training. The program, which established humanitarian demining standards for the Entity Armed Forces in Bosnia-Herzegovina, resulted in the following lessons learned:

- Knowledgeable instructors and quality interpreters were essential. Interpreters had to translate military terminology and technically specific words for proper communication to occur in either direction. Complicating translation even further was the fact that there were multinational instructors, which sometimes made two translations necessary.
- The location of the training played a significant role. An outdoor training area that simulated the local contaminated areas and minefield characteristics and a proper classroom environment were required for a successful training program.

Although the trainees were technical experts at mine employment, destruction, and render-safe procedures, even the most knowledgeable deminer learned procedural aspects of humanitarian demining. The most notable improvement was the establishment of safety procedures in accomplishing demining tasks ranging from basic demolitions and proper use of equipment to the safe conduct of operations in the minefield itself.

One of the biggest challenges was that instructors from the U.S. engineer units had little to no hands-on experience on some of the technical aspects of demining. However, the group discussions and lessons shared among the experienced deminers from various geographical areas within Bosnia-Herzegovina helped make up for any instructor shortcomings.

Some of the challenges deminers faced in Bosnia-Herzegovina included the fact that the deminer had fought near or on the ground he was demining and had possibly lost family or friends; family issues, with the foremost concern being how his family would be supported if he was injured or killed; and recent mine strikes that had killed or injured other deminers.

Minefield Surveys

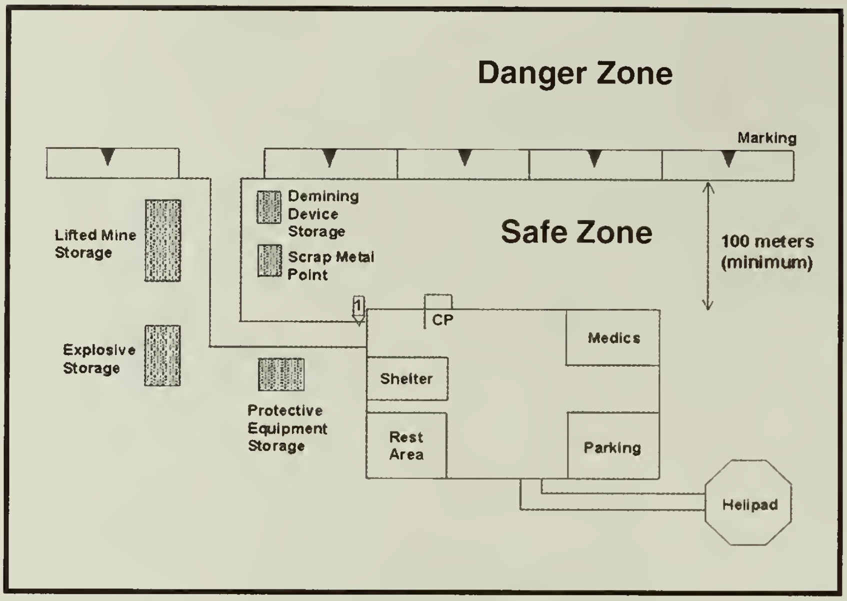
Intelligence and reconnaissance are the first steps of the mine-clearing process. The United Nations Mine Action Center formalizes this in a series of three standardized reports: the Mine/UXO Incident Report, Level One Survey (General Survey); Level Two Survey (Technical Survey); and Level Three Survey (Cleared-Area Completion Survey).

Level One Surveys provide information on the general location of contamination to help establish low- and high-risk areas, set priorities, and establish a database.

Level Two Surveys outline the conduct of a detailed technical survey to determine the contaminated-area perimeter – establishment of safe and danger areas. The survey identifies the types of mines, patterns, and vegetation and reference points and concludes with marking the area.

Level Three Surveys are the final reports that determine that the area is demined after operations. This survey involves turning over the land to the local government and recording the report at the national level.

No final reports of clearing were conducted during operations in Bosnia-Herzegovina. There was a need to maintain an up-to-date record of areas cleared by the military since there was no documentation on the areas cleared during the presence of the initial United Nations Protection Force. Documentation of the extent of military clearing operations—such as checkpoints, camps, and expansions and who conducted the clearance—is unknown. Most of the available clearance information is based on soldiers' knowledge that was passed on from unit transitions or even from foreign soldiers' visits to multinational camps.



Demining-Site Organization

Information Sources

Minefield information is gathered from a number of sources, to include hospitals, police stations, local governmental organizations, local civilians, international organizations (such as the United Nations/NATO), former warring-faction records, and local military forces. The objectives are to determine the force responsible for the contamination, reasons for mining, date and age of the ammunition, capabilities and characteristics of ordnance, and skills of the minelayers in order to determine proper clearing operations.

Challenges

The problems encountered with information collection are significant. The language barrier is the primary obstacle. Other problem areas include the difficulty in obtaining reports due to destruction and loss, conflict in determining accuracy in space and time, imprecise reports, withholding of information for personal gain, local government conflicts, and the fact that the soldier who laid the mine is not the person who is taking it out.

In Bosnia-Herzegovina, general problems included lost records, false reports, and the fact that battle lines fluctuated many times over the same ground. Opposing forces typically changed the original configuration of the minefield. The essential aspect is the collection of minefield information before an operation: How many mines are present? What are the pattern(s) and type(s) of mines? Who laid the mines? This was a significant challenge for the Stabilization Force and the Entity Armed Forces—the engineers on the ground. To obtain firsthand knowledge, the Entity Armed Forces tried to find the engineers who had originally emplaced the minefield, but they often had little success.

Demining Missions

Demining missions are highly detailed, dangerous, and time-consuming operations that involve identifying and clearing all contamination from an area. The missions include site setup and operations in the safe area; operations in the danger area (demining with or without a detector); and demolitions (storage, handling, transportation, and destruction methods).

Site Setup

Site setup is critical to safe demining operations. The safe area contains a command post (radio), check points where the locals/journalists and deminers enter the area, a medic post, a designated helipad, a scrap-metal point, explosive- and equipment-storage areas, a shelter or rest area, and lifted (in the French army, it is neutralized) mine-storage area (see figure above). Each aspect contains a specific function in the overall operation of the mine area and prevents accidents caused by improper storage or transport or lack of control on-site.

Demining Operations

Most humanitarian demining operations involve a mine detector, a probe, or both. Section leaders are responsible for organizing and modifying the detection techniques based on the weather, terrain, types of mines or UXO in the area, and other site factors. The clearance method and approach are typically determined in the site reconnaissance or Level Two Survey. Highly detailed TTP outline procedures for clearing operations, to include safe working distances, methods for marking lanes, establishment of safe lanes, and neutralization (a French army term) or destruction of mines once they are found.

It is outside the scope of this article to describe the demining techniques taught during the French Humanitarian Demining Course, but the planning factors used by the French verify that humanitarian demining is a time-intensive process. For example, on open terrain, a platoon (20 trained deminers) can clear only 600 square meters in 4 hours. In heavy vegetation, the same platoon can clear only 60 square meters in 4 hours.

Final Survey

After completion of demining operations, boundaries are marked, the final Level Three Survey is completed, and the area is handed over to the local government. This handover is critical in establishing a legal transfer of the area and assurances that the area is 99.6 percent clear of mines to a depth of 15 centimeters.

Quality assurance and quality control are critical factors during minefield surveys and demining operations. Observers from the United Nations Mine Action Center or agents of the organization funding the demining operation typically handle external checks. Routine inspections during the demining operation ensure safe operations and proper clearance.

Military organizations are particularly well-organized to conduct both demining and clearing operations such as this. In fact, civilian nongovernmental organizations and the structure of the United Nations Mine Action Center demining teams are very similar to the structure of a military platoon. The complexity of the overall mission regarding interaction with local governments and agencies, civilians, and other nongovernmental organizations and the overall lack of technical training (knowledge of foreign mines and UXO) lead to high-risk operations that are not normally the responsibility of U.S. Army engineers. Technical training is the key, and the nongovernmental organizations have the expertise to perform demining operations. Critical lessons learned and approaches from humanitarian demining can be applied to military clearing operations that are conducted due to a military necessity. Because of time limitations, military clearing operations may not consider all operational aspects at the same level of detail that humanitarian demining does.

A nongovernmental-organization personnel conducts humanitarian demining.

Mine-Awareness Training Programs

Mine-awareness training programs educate people to the danger of mines and UXO. The programs emphasize the importance of the contamination threat, risk involved with living in contaminated areas, and notification of the threat area. The programs disseminate information through posters, pamphlets, comic strips, stickers, T-shirts, newspaper articles, and radio announcements. The best distribution centers are churches, schools, and hospitals since typical mass-media technology such as television is not available to most of the people affected by mines.

The key to successful training programs is to establish them at the national level for standardized initiatives, information processing, and coordination of local demining programs. Local host-nation organizers are necessary to confirm that the message is adapted to the audience—along with being short, simple, and direct, the message must be politically correct. This assessment is best accomplished at the lowest level. Minefield information is also collected and reported through the local representatives to higher-level demining cells. The objective is for regions to continue awareness programs that are established by organizations such as the United Nations or the International Red Cross.

In Bosnia-Herzegovina, U.S. soldiers from psychological operations, EOD, and local civil-affairs teams—in conjunction with engineers—participated in a mine-awareness program. However, the key to a successful mine-awareness program is the establishment of local and regional coordinators, with assistance from international aid organizations. Miles of minefields were marked during the time of the Implementation Force and Stabilization Force, and until the local training program educates the local people to the need to leave minefield-marking material for its intended purpose, the mission will continue. This is just one of many mine-awareness problems that arise. Civilian organizations are best suited for this type of operation.

Conclusion

I believe that it is necessary to establish additional engineer training and expertise so an engineer staff NCO or officer can advise commanders of threats and considerations involving operations in contaminated areas. Engineer expertise is required to support operations that are focusing where contamination is prevalent. Whether the operation is a military area clearance or a nongovernmental organization humanitarian demining, the desired result is the same—a safe area. Important lessons can be drawn from humanitarian demining procedures when conducting clearing operations due to military necessity. Engineer staff officers can implement unit training programs and provide input to the overall operational considerations.

Captain LeMaster is assigned to the 864th Engineer Battalion Combat Heavy, at Fort Lewis, Washington. He attended the French Army Humanitarian Demining Course in 1997 and served in Bosnia-Herzegovina as the MND (North) Mine Action Center OIC and B/16th Engineer Battalion XO. CPT LeMaster is a recent graduate of the Engineer Captains Career Course.

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Demining in Bosnia-Herzegovina

By First Lieutenant Eric Midden

The signing of the Dayton Peace Accords on 14 December 1995 brought an end to war in the former Yugoslavia. Shortly after bridging the Sava River in late December 1995, the Implementation Force (IFOR) began its mission of enforcing the Dayton Peace Accords. One of the primary concerns of the international community was the large number of land mines and minefields in the Bosnia-Herzegovina region. The Dayton Peace Accords addressed the topic of demining and established specific guidelines regarding how the minefields would be removed and what would happen to the stockpiles of land mines held by the former warring factions.

The region known as Bosnia-Herzegovina contains about two to three million land mines. With this many mines in an area about the size of West Virginia, it is easy to see why demining was so important to the IFOR/Stabilization Force (SFOR) and the indigenous personnel.

Command and Control

One of the key steps in demining such a large area was establishing command and control for the demining activities that were mandated by the Dayton Peace Accords. When the Mine Action Center (MAC) was formed in Sarajevo, it created the command and control needed. The MAC has the following missions:

- Tracking all demining operations that take place in Bosnia-Herzegovina.
- Providing overwatch for all demining operations, ensuring that demining is conducted safely and efficiently.
- Maintaining a database on all the known minefields in the region.

Although the MAC monitors demining, the standards by which demining is conducted come from other sources. The Dayton Peace Accords provide the general framework for demining in the former Yugoslavia. With the addition of several SFOR SOPs and the Entity Armed Forces (EAF) SOPs, the standards for humanitarian demining in Bosnia-Herzegovina can effectively be determined. The SOPs explain how many demining teams each EAF must field and specifics on the demining operations that are to be conducted. However, this article focuses on the SFOR monitoring of the demining effort.

From 1995 to 1999, the IFOR/SFOR monitored all EAF demining operations. This meant that in order for the EAF to earn credit for demining, IFOR/SFOR soldiers had to observe all the EAF demining efforts. As a result, monitoring demining operations became one of the primary missions of engineers deployed as part of the IFOR/SFOR.

During the 1999 demining season, ideas circulated about moving from 100 percent monitoring of the EAF to making periodic spot checks. The move has a two-fold purpose: First, spot checks significantly reduce the number of engineers required, allowing fewer engineers to monitor more minefields. Second, periodic checks transfer more of the responsibility of demining to the EAF, who are ultimately responsible for demining their country.

My experience with demining in Bosnia was at minefield 4185 near the town of Olovo in the Multinational Division North. Situated on the southern-facing slope of a ridge that runs for approximately 10 kilometers, minefield 4185 is comprised of several small minefields emplaced to protect the trench lines that run along the ridge. The minefield contains both antitank and antipersonnel mines.

Challenges

Removing any minefield is dangerous, but the minefields in Bosnia-Herzegovina present several unique challenges. While the MAC maintains records of most of the minefields in the region, most of the records are extremely outdated. Several minefields have no records at all—either the records were not recovered from the EAF that emplaced them or the records never existed.

The prevalence of antihandling devices and booby traps makes the minefields that much more dangerous. Furthermore, mines that have been armed and exposed to the environment for several years are more dangerous than mines that are new and simply need to be disarmed. This is because the fuse could be rusted to the body of a weathered mine, preventing it from being disarmed. The fuse also could be more sensitive than it was designed to be. In the best case, the fuse could have gone bad, rendering the mine harmless. The terrain on which the minefields were placed also makes demining difficult. Minefield 4185 is on steep, heavily vegetated terrain, and large amounts of ferrous ore in the soil make mine detectors useless.

Manual Demining

Because of these factors, demining at minefield 4185 and several other minefields in the region is done by hand. EAF deminers use a specialized drill that begins

(continued on page 26)

Moving a Volcano

By Captain Thomas Holland

The development of scatterable mines represents the first true paradigm shift in countermoblity since the American Civil War. The system tasked to emplace the bulk of these mines is the M139 Volcano. By itself the Volcano is portable, robust, and easy to use; it's the vehicle we use to transport the system that's the problem.

In this article, I will define this problem, list some facts that apply to the problem, and discuss some other issues that I omitted from the article. I will explain what I believe are the possible solutions for this problem and will test those solutions. I will conclude with my recommendation for the Bradley Fighting Vehicle (BFV) as the best choice for carrying the M139 Volcano into battle. The purpose of this article is to convince you that the M139 Volcano is our best countermobility system and that it cannot be used to its full capability as it is currently carried into battle.

Identifying the Problem

According to FM 5-100, *Engineer Operations*, "Offensive action is the most effective and decisive way to attain a clearly defined common objective. An offensive spirit must be inherent when conducting all engineer defensive operations." When we fix, turn, disrupt, or block an enemy's maneuver, we are attacking his decision-making process. When we are defending, countermobility operations allow us to seize, retain, and exploit the initiative. It can therefore be argued that countermobility is an offensive operation and then further argued that the Volcano is one of the most powerful offensive weapon systems organic to a brigade.

The problem with the M139 Volcano is the vehicle that transports it. The ground transportation currently available to the M139 Volcano is the M548A3 tracked cargo carrier, the heavy expanded-mobility tactical truck (HEMTT), the 5-ton truck, and (once the conversion kit is approved) the light medium tactical vehicle (LMTV). Anyone who is familiar with any of these vehicles knows that the front "armor" protection consists of a windshield. As a side note, the Volcano can be employed via air by the Blackhawk helicopter, but that is beyond the scope of this article.

It is not currently possible to use the Volcano to leverage our firepower in an engagement because the Volcano can't get to the fight if it is on a thin-skinned vehicle. The concept of the Volcano-emplacement team (VET)—where an armored company team moves forward with a Volcano to provide security—is a good temporary fix to this problem, but why should we allocate that much combat power to a system that can be disabled by small-arms fire?

Facts About the Volcano

The M139 Volcano system consists of four launcher racks, a dispenser control unit (DCU), a hand control unit (HCU), and various cables and braces that connect components and hold the system in place. Each rack holds 40 canisters for a total of 160 canisters. Each canister holds 6 mines for a total of 960 mines. Each system can emplace an 1,100-meter by 120-meter minefield in a matter of minutes.

The M87 canister contains five antitank (AT) mines and one antipersonnel (AP) mine. The M87A1 contains six AT mines. The AT mines are bidirectional, magnetically fused and, therefore, antidisturbance. Once the AT mine has armed itself and adjusted to the earth's magnetic field, any disturbance of that field (such as a tank or moving the mine) will cause the 1.3 pounds of RDX (cyclonite) to explode, thus firing the S-F warhead. The AP mines deploy 8 trip wires up to 40 feet and require only 0.9 pounds of pressure to detonate the 0.9 pounds of Composition B that make up its main charge. Fatal casualties result at up to 15 meters. At the end of the set duration time of the mine (4 hours, 48 hours, or 15 days—as set by the operator), it will explode. The bottom line is that a Volcano minefield will kill anything that encounters it, is virtually impossible to breach by manual means, and goes away at a predetermined time (self-destruct occurs exponentially with 99.999 percent compliance).

Discussion

There are two important points to discuss concerning my screening and evaluation criteria. The first point is that the screening criteria I chose eliminate every vehicle we currently use to transport the Volcano. This was not

An M548A3 transporting the Volcano

An MLRS chassis with the Volcano

done intentionally and is not to say that our current choice for Volcano transporters was a mistake. The point is that we have recognized new uses for the system, and our current vehicles will not support those uses that carry the Volcano into direct-fire range.

The second point concerns a possible modified table of organization and equipment (MTOE) change. I am making the assumption that a choice to replace the M548A3 with the Multiple-Launch Rocket System (MLRS) chassis would be a one-for-one swap, and the Volcano system itself would not change. Conversely, a choice for the Bradley could mean either a one-for-one swap with the M548A3 or the elimination of the M548A3 and the outfitting of every "Engineer Bradley" with a Volcano. I did not look at MTOE as a criteria because I don't have the data to evaluate these two vehicles based on the multiple issues an MTOE change would bring, such as cost reduction by deleting the M548A3, cost increase by redesigning the Volcano to fit the Bradley, and doctrinal changes to the employment of combat engineers. These are important issues, but unless someone is willing to take this article from drawing room to boardroom, these issues will not materially affect this discussion.

Possible Solutions

I used the following screening criteria to determine what vehicles were acceptable to put the Volcano on:

- Already in the inventory.
- Survivability.
- Commonality of parts.
- Trafficability.

The two vehicles I came up with are the MLRS chassis and the M2 BFV. Both vehicles meet all the criteria and are familiar to most officers in a combat-arms branch. For this reason, I will skip the detailed explanation of each vehicle's capabilities and focus on the criteria I chose.

Already in the Inventory. It is important to consider a vehicle that is already in the Army's inventory because it takes too long to develop new systems, debug them, and then figure out how to maintain them. While there will be a requirement to test the viability of a Volcano on any new chassis, this process is much less complex than building a new system from scratch. Perhaps the best reason to choose a vehicle that is already in the system is the same reason that General Shinseki wants to field the medium brigades with "off-the-shelf" systems—momentum. The Army of Tomorrow, Force XXI, and the Strike Force were all valid concepts, but they lost funding because they lost momentum. We can put a Volcano on an MLRS or Bradley chassis within 18 months if we are decisive in our action.

Survivability. The primary reason that the Volcano should be on an armored vehicle is survivability. I don't know if there is a windshield made that will stop shrapnel, but I do know that such a windshield is not on any of the vehicles that currently carry the Volcano. The Volcano is relatively easy to operate, but it does require training. What are the implications of sending an armored company team forward to emplace a Volcano obstacle only to have the operator become a casualty before the mission is accomplished? Would a maneuver commander even be willing to send a thin-skinned vehicle into direct-fire range of the enemy? I believe the answers to these questions are apparent, and they relegate the best countermobility asset we have to a "second-string" role.

Commonality of Parts. If maintaining the operator of the Volcano is the number one priority, then maintaining the vehicle the Volcano rides on is a definite second. This is why a commonality of parts is important. With the Corps of Engineers due to turn in its M113s for BFVs, the next logical step is to find a Volcano transporter that will be able to share parts with the line-platoon vehicles. Choosing the Bradley has obvious implications for commonality of parts and therefore an advantage over the MLRS chassis. However, since the MLRS chassis has the same drivetrain as the BFV, it stands to reason that it will also keep down the number of lines of the prescribed load list needed to maintain the vehicle.

Trafficability. The Chief of Staff of the Army has declared that the Army is going to get lighter. However, I cannot help but think that we may be missing an important lesson—that the failed German invasion of Russia may have been as much from not choosing the proper equipment as from overextending lines of supply. During Operation Barbarossa, the German army had to use its tanks (when it could get them unfrozen) to tow its trucks because the trucks just could not move in the mud and snow. So, since the Germans could not get their wheeled trucks to the front, I draw the correlation that a "wheeled" Volcano will not always get to the fight.

Testing the Solutions

I chose the following criteria as being feasible to evaluate, acceptable after a reality check, suitable for the problem, and distinguishable between the two options:

- Recognizability.
- Availability.

The M2 Bradley Fighting Vehicle

- Trainability.
- Reporting.

I established these criteria based on my 32 months as a combat-engineer platoon leader, 10 of which were spent as a Volcano platoon leader (my battalion formed a platoon from the line companies' Volcanoes). These are issues I faced when making recommendations for the best way to employ Volcanoes in missions such as Bright Star and the defense of Kuwait by the Division Ready Brigade.

Recognizability. This ties directly to the screening criteria of survivability. The intent here is to facilitate the standard essential elements of friendly information requirement to "hide" Volcanoes because they are high-value targets. The current problem is that the Volcano is easy to identify because it is carried by the M548A3, which has only one purpose—carry the Volcano. While moving the system to the MLRS chassis would confuse the enemy about what it might be shooting at, it probably would not care because the MLRS is also a high-value target. However, a Volcano on a BFV could easily be confused for a Bradley Stinger Vehicle, a Linebacker, a Bradley Smoke Vehicle, or any one of the 200+ BFVs in a mechanized infantry brigade. A Volcano on a Bradley would be difficult to recognize.

Availability. This criterion follows the logic of fielding the medium brigades with off-the-shelf technology—that the changes that are necessary will not take place if the concept does not achieve and maintain the momentum necessary to complete the task. In comparing the two vehicles, MLRS chassis (in the words of one United Defense employee) "are as rare as hen's teeth." And although no more BFV hulls are being made, the fielding of the Operation Desert Storm Bradley, the turn-in of Bradleys by mechanized scout platoons, and the fact that the Bradley is the most widely used combat-vehicle platform in the U.S. Army make the Bradley much more available for use than the MLRS chassis.

Trainability. This refers to the friction a battalion commander must overcome to keep a Volcano crew trained. Since the death of the 12F military occupational specialty (engineer tracked-vehicle crewman), 12Bs (combat engineers) have taken over the responsibility of operating assault and obstacle (A&O) platoon equipment. This means that a Volcano operator today may be a grapnel man tomorrow and vice versa. By the same token, the skills necessary to operate the MLRS in an A&O platoon (where I am assuming the Volcanoes would stay) will not transfer directly to the skills necessary to operate the BFVs in a line platoon. It is apparent that the skills necessary to operate a Bradley with a Volcano would translate directly to the skills necessary to operate a Bradley without a Volcano and, therefore, the Bradley has the advantage for trainability.

Reporting. Although the Bradley has the advantage in the first three criteria, the MLRS chassis has a definite advantage in reporting. This is because the celestial navigation system available with the MLRS chassis will facilitate quick, accurate reporting of minefield locations without worrying about "plugger" batteries. Planning minefields is important, emplacing minefields is critical, but reporting on the location of minefields is the long pole in the tent for an Army that expects victory via agile, decisive maneuver. The Bradley has no discernable advantage over the M548A3 for reporting, but the MLRS chassis provides a capability that no other system evaluated can match.

Conclusion

The Duke of Wellington said that "Junior officers must either master terrain or the language of the conqueror." His words are as true today as they were in his day. No system in our arsenal has ever let us dominate terrain the way the Volcano has. However, leveraging combat power by means of the Volcano is only possible if its transporter is a vehicle that can go into the fray and survive. I believe the best vehicle to accomplish this mission is the Bradley Fighting Vehicle. Although it does not have the reporting advantage of the MLRS chassis, it is less recognizable, more readily available, and simplifies training and maintaining qualified crews.

The whole point of this article is to substantiate my claim that we are underutilizing our most lethal countermobility asset and thereby limiting the commanders' ability to apply combat power to the decisive point of a battle. In short, the Volcano cannot be used properly if it cannot cross lines of departure.

CPT Holland is the S1, 577th Engineer Battalion, Fort Leonard Wood, Missouri. He was previously the Assistant S3, 5th Engineer Battalion, Fort Leonard Wood. At the 317th Engineer Battalion, Fort Benning, Georgia, he was a line platoon leader, an A&O-platoon leader, and a Volcano-platoon leader. CPT Holland has two NTC rotations as a platoon leader and numerous platoon through task-force combined-arms field problems.

A Light Combat-Engineer Platoon in Kosovo

By Captain Andrew J. Short

When the 1-187 Infantry Battalion, Fort Campbell, Kentucky, deployed to Kosovo in February 2000 to participate in Operation Joint Guardian, it left with a complete task force to enhance the battalion's operations and effectiveness. Subsequently, Fort Campbell's 326th Engineer Battalion (Air Assault) attached a sapper platoon to the task force. The habitually associated platoon from Charlie Company deployed with the infantry battalion. While engineers comprised only a small number of the 900-man task force, the diversity and flexibility of the light combat-engineer platoon made it a valuable asset.

Task Organization

The sapper platoon (1/C/326th)— three 8-man squads, a platoon leader, a platoon sergeant, and a driver—deployed with its entire modified table of organization and equipment. In keeping with the divisional readiness force package, two small emplacement excavators (SEEs) and their operators and a medic also deployed with the platoon. Because an infantry task force has no 62B mechanics, a skilled junior mechanic was included to work on any problems associated with the SEEs. The battalion also requested that a vertical engineer squad from the XVIII Airborne Corps be attached, so a squad from the 27th Engineer Battalion, Fort Bragg, North Carolina, was added to the task force.

Instead of having each squad of the platoon tasked to each infantry company, the task-force commander decided to keep the sapper platoon together and attach it to one of the infantry companies. The decision made it necessary to include an additional lieutenant to serve as the task-force engineer so the platoon leader could stay with the platoon. The vertical squad fell under Headquarters and Headquarters Company/1-187 and worked for the task-force engineer.

Sapper Platoon

Unlike in the mechanized world, where an engineer company supports a maneuver battalion, the air-assault infantry battalion is supported by one sapper platoon. Throughout the deployment, the sappers showed the diversity of 12B soldiers and their ability to serve in many different capacities. While in Kosovo, the platoon served as another light infantry element. Initially serving with D/1-187 in the town of Klokot, the platoon conducted both dismounted and mounted patrols, guarded Serbian churches, and manned traffic-control points (TCP). In addition, both the platoon leader and squad leaders worked with the local mayors and people in the cities of Klokot, Zitinje, and other surrounding villages on a daily basis. They conducted numerous house searches of suspected criminals or curfew violators, looking for weapons or other contraband. The platoon's ability to serve as infantry was a great asset to the task force. More than 80 percent of the platoon's NCOs have attended Sapper School, and the skills they learned there, along with the training performed as part of the 101st Airborne Division, provided them with the skills needed for mission success.

In May, the platoon moved northeast into the Russian sector to run a checkpoint along the Kosovo-Serbian border with the Russian soldiers. Here, U.S. and Russian soldiers ran a TCP and searched every vehicle and person entering Kosovo. Working out of Camp Monteith in Gnilanje, the platoon rotated the squads every 8 hours for the 10 days they were there. As part of a joint Kosovo Force effort, it was an experience that the platoon will never forget.

On four occasions, members of the platoon participated in battalion-level cordon-and-search operations. The sapper squads were equipped with AN/PSS-12 mine detectors but served in many different roles. In some cases, an element would perform a deliberate route clearance of a road or path so either vehicular or dismounted traffic could pass. The squads also swept haystacks, barns, and the surrounding grounds of houses with the mine detectors in search of buried caches of weapons or mines. In addition, the squads sometimes set aside the detectors and searched houses. On one mission, the engineer squad served as the battalion main effort and conducted a deliberate route clearance and searched suspected cache sites. Another mission called for a sapper squad to be on the first lift of an air assault into a village in order to clear a route through a suspected mine area.

The sappers also conducted three tree-cutting missions for the task force. In one case, trees were cut down with chain saws to improve fields of fire and clear dead space next to the battalion headquarters complex. In the other two missions, sappers helped the battalion S5 supply local Serbs with trees for firewood for the upcoming winter. The trees were taken down with detonation cord and C4. The squads conducted a recon of the site, performed hasty calculations, and then moved to the area the following day to conduct the mission.

In addition to the tree-cutting missions, a squad conducted a live breach with bangalores on a range. The sapper platoon also put up wire for protection around the battalion headquarters, conducted aerial reconnaissance of the sector to view possible obstacle sites, emplaced wire at a TCP site in anticipation of a possible riot, and conducted bridge and ford reconnaissance in sector to improve the mobility of tracked vehicles. Certainly, the engineer platoon offered the task force a very flexible element that could perform a multitude of tasks.

Vertical Engineer Squad

Most of the projects performed by the vertical engineer squad involved improving the quality of life for soldiers at remote sites. The six-man squad constructed six permanent, general-purpose, medium tent "huts" and more than 70 bunk beds. Other projects included designing and building the interior of the battalion mailroom, desks and tables for the battalion administrative area, and guard towers and detention shacks at the company command posts. During cordon-and-search operations, the squad repaired any damage to local houses that occurred during the searches. In addition, they ran a TCP during a crisis operation. The vertical engineer squad enabled Task Force 1-187 Infantry to complete projects without requesting support from the parent engineer battalion attached to Task Force Falcon.

Task-Force Engineer

The task-force engineer worked in the battalion headquarters and served as the principle advisor to the commander. In addition to working with the 1-187 staff members, the task-force engineer dealt extensively with the Base Camp Coordinating Agency, the construction management section, and the contractor (Brown & Root Services Corporation). The task-force engineer was the primary spokesman for the battalion while planning and developing its headquarters in Vitina. He also coordinated with the 16th and 82d Engineer Battalions for other projects and missions, pulled battle-captain shifts, helped the local civil-affairs team with a cleanup project, and advised the battalion commander on force-protection issues.

Lessons Learned

The deployment of 1/C/326th Engineer Battalion to Kosovo was a true test of the capabilities of an air-assault sapper platoon. Several lessons were learned from the deployment:

- A platoon should deploy with all of its equipment. Before leaving, many items on the platoon leader's hand receipt were questioned as to whether they should be taken to Kosovo, but the decision to take all equipment paid dividends. Even though the mentality was of operating as a light infantry platoon, the 1-187 used the platoon as engineers on many occasions. Having properly maintained chain saws, tools, and equipment allowed the platoon to complete every mission.
- The vertical engineer squad from the 27th Engineer Battalion was a valuable asset to the task force in Kosovo. However, future deployments by light infantry

Soldiers from C/326th Engineer Battalion conduct a tree-cutting operation in Kosovo.

task forces to this theater will probably not need this attachment. The infrastructure has been established in Kosovo, and the projects for vertical engineers are decreasing.

- An additional officer to serve as the task-force engineer is needed only if the sapper platoon is kept together. Should a task-force commander decide to split up the platoon and attach engineer squads to infantry companies, the platoon leader can easily perform both platoon-leader and task-force-engineer duties.
- Training on soldier tasks other than 12B-specific ones will help improve the readiness of engineers on future Kosovo deployments. Devoting time to patrolling, military operations in urban terrain, checkpoints, searches (vehicle and individual), and other squad- and platoon-level tasks during training will help prepare engineers for missions they will perform on a Balkan deployment.

Redeployment

The leaders and soldiers of C/326th Engineer Battalion returned to Fort Campbell with the confidence and knowledge of the great job they did in Kosovo. The importance of training as both a combat engineer and an infantryman took on new meaning to them. The light combat-engineer platoon's diversity and flexibility made it a valuable asset to the battalion.

Captain Short was the task-force engineer for 1-187 Infantry Battalion. He previously served as a platoon leader and executive officer in the 326th Engineer Battalion, Fort Campbell, Kentucky. A graduate of the United States Military Academy, CPT Short has completed the Engineer Officer Basic Course and the Airborne, Air Assault, Ranger, and Sapper Schools.

Editor's Note

The bulletin staff thanks Mr. Brian M. Green, a project management engineer for the U.S. Army Project Manager for Mines, Countermine and Demolitions, Countermine Division, Fort Belvoir, Virginia, for reviewing the mine articles in this issue. Mr. Green is a Marine combat-engineer officer who fought in the Gulf War and has been to Somalia, Bosnia, and Korea (three times). He advised on the removal of minefields in Guantanamo Bay, Cuba, and wrote and edited the Humanitarian Demining Equipment Planning Guide for the theater commanders in chief. He has been officer-in-charge of the Marine detachment at the National Ground Intelligence Center, a mine-warfare analyst, chief of the Mine Warfare Branch and instructor at the U.S. Army Engineer School, and subject-matter expert on mine/countermine warfare for the school for two years. Mr. Green has authored several articles for *Engineer.*

(continued from page 20)

when the deminer establishes the start point of the 1-meter lane that he will work. After checking the area immediately in front of him with a trip-wire feeler, the deminer removes all the vegetation from the area that he has cleared of trip wires. Then he probes the area for mines, inserting the probe 6 centimeters into the earth at about a 30-degree angle every 2 centimeters across the entire 1-meter width of the lane. If nothing is found, then the deminer moves forward 6 centimeters and probes again. Once he reaches the end of the area he has cleared of vegetation, he starts the entire drill again. This slow and tedious process typically results in one lane—about 50 to 60 square meters—being cleared each day.

At minefield 4185, about 100 to 120 square meters were cleared in a day. While this may sound like comparatively good progress, it is important to look at in relation to the area that the minefield covers, which is about 4 grid squares or about 4,000,000 square meters. At the current rate of demining, it will take 33,000 to 40,000 days to clear this minefield.

Lessons Learned

While deployed as part of SFOR 6 from August to December 1999, our platoon learned several valuable lessons about demining in Bosnia-Herzegovina:

- Establish a good working relationship with the EAF deminers. We found that by doing this, our EAF team would do the things that we asked them to do. But even though a good working relationship helped make the job easier, it did not replace the need for supervision.
- Establish strict standards by which deminers are to work. If our standards were not met, the team knew that it would not receive credit for its efforts. This encouraged deminers to safely and effectively work the required 4 hours a day.

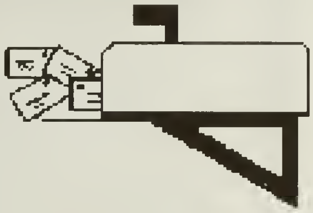
Conclusion

While the war in Bosnia-Herzegovina may be over, the country is far from being where it was before the outbreak of the fighting. The efforts of the IFOR/SFOR have made a difference. Although it is several years from being completed, the demining of the region is well underway. More important are the decreasing SFOR troop strengths. The people of the country are beginning to govern themselves again and take responsibility for their actions. The move from constant monitoring of demining to periodic spot checks is a prime example of this progress.

Where there has been conflict, there will be mines, so future contingency operations will require expertise in mine clearance and humanitarian demining. That means that engineers will be needed to oversee the clearing operations of every mission.

First Lieutenant Midden is the maintenance officer for the 1st Engineer Battalion, Fort Riley, Kansas. While in Bosnia, he was a platoon leader in B Company, 1st Engineer Battalion. 1LT Midden is a graduate of the University of Missouri-Rolla.

Letters To The Editor



Engineers Train With New, Advanced Equipment

The October 2000 issue of *Engineer* contained an article by PFC Matthew J. Jenkins titled "Engineers Train With New, Advanced Equipment." This equipment, which was a part of the Joint Contingency Force Army Warfighting Experiment held at Fort Polk, Louisiana, in September 2000, included a description of the Volcano (Light).

Paragraph one states that "The Volcano (Light) is designed to lay a minefield about 900 feet long and more than 110 feet wide." Minefield size in any Volcano-installed minefield is directly related to the density (number of mines per square meter) and the total number of mines dispensed for the minefield. I caution readers to keep this in mind. A large minefield may contain many or few mines. The same is true for a small minefield. Minefield density and minefield size are independent of each other and are determined by the commander and the laying crew, not the device. Do not jump to conclusions that the Volcano (Light) has this amazingly advanced capability in such a small HMMWV-mounted package that it is able to replace the normal Volcano in the normal Volcano mission.

Paragraph two states that "...canisters, each containing five antitank mines and one antipersonnel mine. ...When the mines hit the ground, trip wires spring out of each mine to prevent the enemy from passing safely."Only the M87 mine canisters contain an antipersonnel mine along with the five antitank mines. The main canister in our war stock is the M87A1, which contains only antitank mines. Most importantly, only the antipersonnel mines contain/eject wires. Antitank mines contain none.

A warning note: Volcano-launched antitank mines do not have antihandling devices, but they DO have antidisturbance integrated into them. Movement of an armed Volcano mine is extremely technologically complicated and is NEVER safe. NEVER attempt to move ANY Volcano mines that have been dispensed!

Mr. Glenn Boxley
Combat Developer
U.S. Army Engineer School
DSN 676-7337

U.S. Army Prime Power: A Tradition of Innovation and Excellence

An article by CWO2 Andrew K. Potter in the July 2000 issue of *Engineer* ("U.S. Army Prime Power: A Tradition of Innovation and Excellence") refers to Camp Century, Greenland, a site that "generated power from more than 30 feet below the polar ice cap" as part of the Army Nuclear Power Program.

I'm glad to see there is some solid, accurate recognition of Camp Century and what we tried to do there. As a young SP4 radio-teletype operator with the Polar Research and Development Center at Fort Belvoir, Virginia, I made four trips to Greenland in the early 1960s. A lot of our communication from the camp was by Morse code—there was no such thing as a Global Positioning System! It was an adventure and perhaps the most memorable time of my life. Thanks for remembering what we did.

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Dynamic Theater Bridge Management: *The Korea Challenge*

By Lieutenant Colonel Scott F. "Rock" Donahue

> *"Bridges are always central features in war. Battles and campaigns are often decided by who holds the bridge, or seizes the bridge, or destroys the bridge."*
>
> *Stephen E. Ambrose*
> *Pegasus Bridge*

The Korean peninsula is 84,542 square miles (219,020 square kilometers). About 80 to 85 percent of it is mountainous, and it is cut by nearly 2,400 miles (3,862 kilometers) of waterways. The rugged terrain and temperate climate produce a land with literally thousands of wet and dry gaps. It is clear that if the campaign plan to deter hostile acts of external aggression against the Republic of Korea (ROK) and defeat an external armed attack against the Republic should fail, decisive operations would entail multiple river crossings. The relative shortage of standard military bridging assets to support these potential operations posed a significant challenge to both ROK and U.S. engineers.

In January of 1999, the Commander in Chief (CINC) of the United Nations Command and Combined Forces Command and the Commander, United States Forces Korea, directed the development of a detailed theater bridge-management plan (TBMP) to support component schemes of maneuver. The significance of his guidance is adequately summed up by noted military historian Stephen Ambrose, who concluded that bridges can be the decisive element in military campaigns.[1] This axiom holds equally true for the battlefield employment and management of military float and fixed bridges in the Korean theater of operations (KTO).

The Challenge We Face

To meet the CINC's intent, the Combined Forces Command engineer staff—with direct support from the United States Forces Korea, Eighth United States Army, and ROK field army engineer staffs—developed a dynamic TBMP to optimally allocate limited theater bridging assets to meet campaign requirements. Additionally, the TBMP provides guidance on the appropriate forward movement of assault float bridges in the forward combat zone and the timely replacement of military bridging in the corps rear areas and communications zone. Bridging stock such as the ribbon bridge, the medium girder bridge (MGB), and the M2 Bailey bridge must be aggressively managed throughout the condition-based campaign to sustain the tactical mobility of assaulting forces, to facilitate the operational momentum provided by support and follow-on forces, and to sustain the lines of communication (LOCs) from rear areas to allow sufficient throughput capacity on main supply routes.

Several alternatives were examined to mitigate bridging shortfalls. These options included ensuring the early arrival of off-peninsula U.S. Army ribbon-bridge companies to meet the CINC's required delivery dates; tailoring U.S. and ROK bridge-modernization programs to meet the theater's unique needs (for example, converting to the multirole bridge company, fielding the Wolverine heavy assault bridge, and developing a suitable LOC bridging system); and employing military causeway systems as well as proven, commercially manufactured panel bridging.

Bridge-Employment Concepts

The purpose of a deliberate wet-gap river crossing is to rapidly project combat power across a water obstacle at a faster rate than the enemy can generate his counterattack forces, while minimizing the impact of the river on the ground commander's ability to maneuver his forces.[2] In the KTO, three types of bridging operations are conducted throughout the campaign under various battlefield conditions:

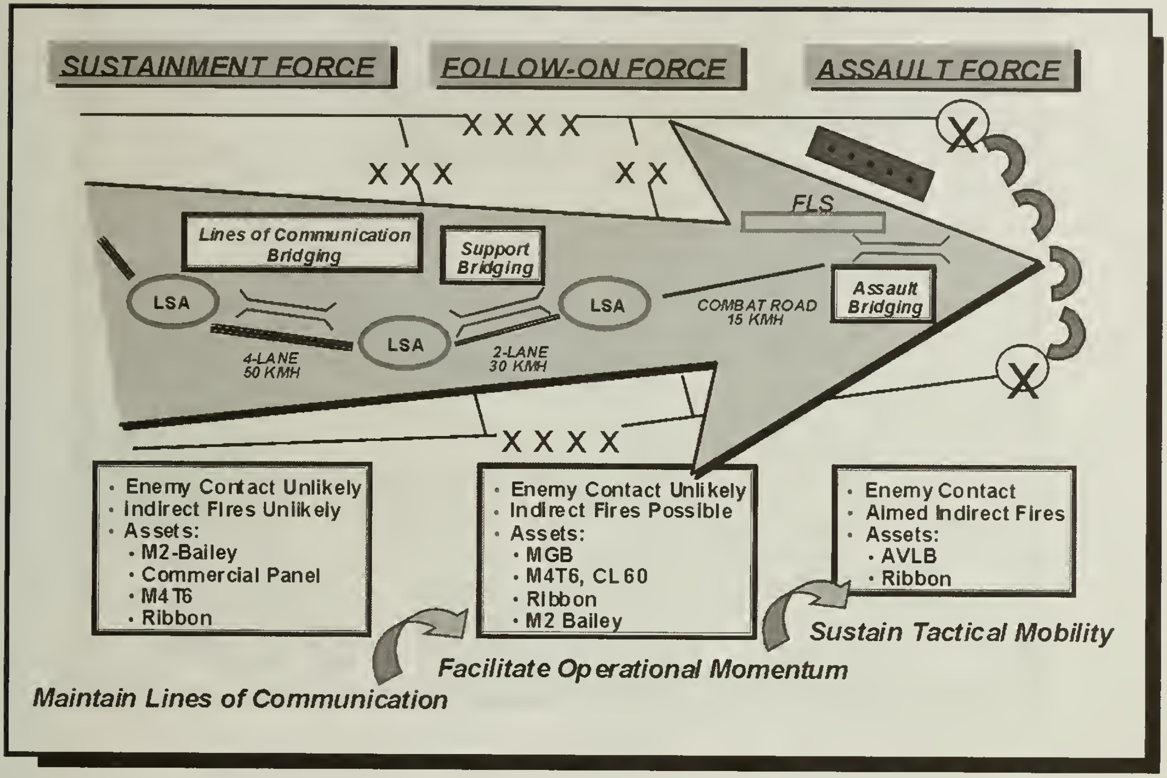


Figure 1. Employment of theater assault, support, and lines-of-communication bridging throughout the battlefield framework

- Assault bridging (when in contact with the enemy and exposed to direct and observed indirect fires).
- Support bridging (when enemy contact is unlikely but the possibility exists of exposure to observed indirect fires).
- LOC bridging (when enemy contact is very unlikely and there is no imminent threat of direct or indirect fires).

Both ROK and U.S. assault bridging assets (such as the armored vehicle-launched bridge [AVLB] and the ribbon bridge), support bridging assets (such as the MGB, M4T6, and Class [CL] 60), and LOC bridging assets (such as the M2 Bailey bridge and commercially available panel bridging) are an integral part of the maneuver commander's combined assault, follow-on, and sustainment forces, respectively. They are doctrinally employed throughout the depth of the battlefield framework, as depicted in Figure 1, to ensure continuous operational tempo. The preferred bridging assets to support these three forces are prioritized based on the likelihood of enemy contact, the threat of indirect fires, and the speed at which the assets can be employed.

Both ROK and U.S. ribbon-bridge companies have the same organization and equipment. Consequently, these units are interchangeable. Combined training between ROK and U.S. Army ribbon-bridge companies is conducted routinely on the Korean peninsula. This is critical to support the flexible task organization required to support decisive operations. A ROK or U.S. ribbon-bridge company can span 215 meters and cross 200 vehicles per hour under normal crossing conditions. The two most limiting factors for ribbon-bridge employment are the required river depth of 24 inches (0.61 meters) to support the minimum draft of the bridge and the river velocities. Higher river velocities necessitate crossing under caution or risk conditions. The table below depicts the maximum capabilities and planning factors for employing ROK and U.S. ribbon bridges.[3]

ROK/U.S. Ribbon-Bridge Company

Components	Quantity	Capability	Planning Factors
Bridge platoons	2	Six 6-float rafts (2 ramp bays/ 4 interior bays): MLC 70* **or** 215 meters of bridge (2 ramps/ 30 interior bays): MLC 96* wheeled/70* tracked (*normal crossing w/max current velocity of 1.75 mps [6 fps])	**Raft construction:** 15 min/6-float raft **Bridge construction:** 200 m/hr (day); 133 m/hr (night) **Bridge retrieval:** 1-2 hours/215 m **Crossing rate (200 m):** 200 veh/hr at 16 km/hr per vehicle and 30 m spacing
Support platoon	1		
Interior bays	30		
Ramp bays	12		
Bridge-erection boats	14		

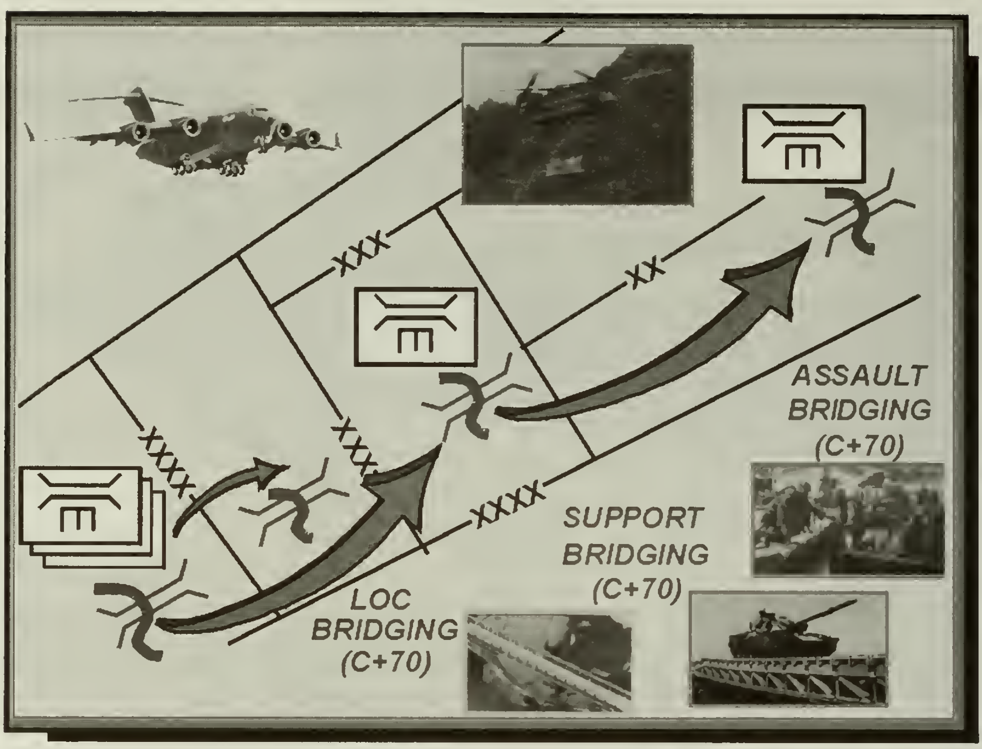


Figure 2. Dynamic assault float bridging on successive river crossings over a notional timeline

Both ROK and U.S. MGB assets, as well as ROK M4T6 and CL 60 support bridging, must be rapidly emplaced to return assault bridges to the close battle. Additionally, fixed bridges such as the ROK and U.S. M2 Bailey bridge, the theater's primary LOC bridging asset, are required to replace bridges lost due to friendly interdiction and friendly/enemy denial operations throughout the campaign. These assets will open and sustain movement along mobility corridors. Fixed bridges are "labor-intensive and expose personnel to enemy fire during construction but provide stable gap-crossing support for continuous operations."[4]

Dynamic Assault Float Bridging

The ribbon bridge is the theater's primary assault float bridge. Both ROK and U.S. ribbon bridges must be continuously and dynamically emplaced, retrieved, replaced, and then moved forward ("leap-frogged") with assaulting forces to adequately support successive deliberate river-crossing operations to sustain tactical mobility. These assets are moved forward via airlift or ground/air transport. Assault float bridges are then replaced by support/LOC bridging within 4 to 10 days, or as soon as battlefield conditions and equipment availability permit. The assault float bridges are then returned to attacking forces. U.S. doctrine recommends recovery of these bridges after 72 hours; however, extended lines of communication, constrained logistics and transportation assets, and extensive fixed-bridge requirements make this nearly infeasible in the KTO.[5]

Dynamic assault float bridging was deemed the most suitable, feasible, and acceptable course of action to provide component commanders the capability to conduct river-crossings within available time, space, and resources. Additionally, this method of assault-float-bridge employment provides a tactically and operationally advantageous scheme of bridging operations, within acceptable risk, that justifies the dynamic allocation of this critical resource. Figure 2 depicts the concept of dynamic assault float bridging on successive river crossings over a notional timeline. The snapshot at C+70 indicates that assault, support, and LOC bridging will likely be conducted concurrently across the battlefield throughout the campaign.

Component Estimates and Analysis

Estimates for component float- and fixed-bridge requirements were developed and analyzed over the course of approximately 18 months. Combined Forces Command engineers published several point papers for senior military decision makers to frame the theater bridging challenges and present the concept of dynamic bridge management. Additionally, numerous combined deliberate planning sessions were conducted between December 1998 and March 2000 to refine bridging estimates and develop the TBMP. Amphibious operations analysis conducted by the U.S. Army's TRADOC Analysis Center at Fort Leavenworth, Kansas, from 1998 to 1999 was also used to assess the impact of additional theater bridging operations.

The following assumptions were made to analyze component estimates within the context of dynamic assault-float-bridge management:

- Arriving U.S. Army bridge companies will be fully sourced.
- Reception, staging, onward movement, and integration of arriving U.S. Army bridge units will take an average of 12 days.
- Successive river crossings will take place at the times estimated by the C3 Operations Analysis Branch and the Center for Army Analysis modeling efforts.
- One hundred percent of the assault float bridges will be leap-frogged from one river crossing to the next, excluding the additional assets allocated for maintenance and loss or damage.
- Assault float bridges must be replaced by support or LOC bridging.
- Existing fixed bridges that span less than 18 meters will remain intact.
- Twenty-five percent of the existing fixed bridges between 18 and 50 meters in length will have one span destroyed, but the piers and abutments will remain intact.
- Fifty percent of the existing fixed bridges that are more than 50 meters in length will have two spans destroyed, but the piers and abutments will remain intact.

Based on historical data from the most recent U.S. contingency bridging operations on the Sava River in Bosnia in 1995, we estimated three different factors for maintenance and loss or damage to assault float bridges: 10 percent for supporting-effort river crossings, 20 percent for main-effort river crossings conducted early in the campaign, and 30 percent for main-effort river crossings conducted in support of decisive operations later in the campaign. The 10 percent increase for main-effort river crossings accounts for the extended use and expected loss, damage, and accumulated wear on component bridging assets. Fundamentally, these planning factors imply that 70 to 90 percent of all assault float bridges are retrieved, replaced by support or LOC bridging, then moved forward to the next crossing site. Additionally, we estimated a 25 percent redundancy for bridge-erection boats at each crossing site and that assault bridging units that were reduced to below 75 percent combat effectiveness would be reorganized to sustain tactical mobility.[6]

Preliminary analysis was conducted using a heuristic algorithm that fully resourced assault float bridges for one river-crossing operation before resourcing the next. Initial results indicated that unconstrained bridging estimates exceeded available resources. Several alternatives were examined to mitigate the shortfall. Options included continually refining river-crossing estimates to adequately support component schemes of maneuver, decrementing supporting-effort river crossings within an acceptable degree of risk, adjusting the arrival date of off-peninsula U.S. Army ribbon-bridge companies to meet the CINC's required delivery dates, enhancing fixed-bridge denial plans to preserve assault float bridging early in the campaign, and employing military causeway systems as well as proven, commercially manufactured panel bridging to lessen the burden on standard military support and LOC bridging.

The Theater Bridge-Management Model

Combined Forces Command engineers concluded that although the heuristic algorithm approach was an acceptable technique to analyze assault-float-bridge requirements, it didn't guarantee a mathematically optimal solution. Additionally, this approach couldn't handle the mixing of different bridging factors or varying constraints. Most importantly, it couldn't provide the detailed sensitivity analysis necessary to develop a balanced theater-wide float- and fixed-bridge emplacement strategy. As a result, Combined Forces Command engineers initiated a cooperative modeling effort with the C3 Operations Analysis Branch in October of 1998 to develop an interactive, versatile, responsive, and transportable PC-based analytical tool using cost-effective, commercially available, off-the-shelf software that allows timely analysis on multiple river-crossing schemes to ensure near-optimal allocation of scarce bridging resources.

Visual Thinking International's object-oriented simulation package, SIMUL8, was used to develop the Theater Bridge-Management Model (TBM2).[7] A working prototype was completed by September 1999, and the model was fully verified and validated by May 2000. The TBM2's flexible network methodology provides unique interactive assumption testing and rapid course-of-action building and feasibility analyzing that complement the capabilities of existing combat models (such as TACWAR and ELIST). Its versatile architecture provides the capability to rapidly modify the model and input parameters to reflect the specifications and framework of a wide variety of logistics and transportation problems (such as demilitarized-zone obstacle breaching and lane expansion). Model results are then easily exported to Microsoft® Excel to generate parametric statistics and evaluate measures of effectiveness.

Key Bridging Issues

Three key bridging issues continue to be examined in support of the TBMP:

- Increasing the number of U.S. Army assault-float-bridge companies allocated to the KTO in the event of a major theater war.
- Assessing the availability and employment of nonstandard-bridging stock (such as military causeway systems and commercial panel bridging) to mitigate theater fixed-bridge shortfalls.
- Refining the plan for employing fires to limit damage to key bridges to minimize engineer repair efforts.

Although not all-inclusive, these issues represent the general focus of the Combined, Joint, and Army engineer staffs to finalize the TBMP.

(continued on page 33)

PERSCOM Notes

By Lieutenant Colonel John R. Luce

Here is a quick update on a couple of important items and some additional information you may find useful.

Current MOS Strengths

Overall, we are doing very well in the Regiment. Several of our MOSs have made great increases in strength during the last two years. The table below shows our current strengths.

MOS	Authorized Strength	Strength (percent)	MOS	Authorized Strength	Strength (percent)
12B	8,076	108	52E	187	87
12C	655	112	62E	1,339	109
12Z	264	101	62F	263	111
00B	133	63	62H	98	90
51B	872	100	62J	719	88
51H	420	99	62N	438	102
51K	112	125	81L	255	103
51M	243	124	81T	411	86
51R	129	124	81Z	25	88
51T	245	118	82D	110	105
51Z	134	107	**Total**	**15,128**	**106**

As you can see, the strength of many of our MOSs is at or above 100 percent. This is great news. However, there are several we need to improve: diver (00B), prime-power-production specialist (52E), and topographic analyst (81T). Additionally, we have a very critical need for airborne-equipment operators (62E and 62J, especially privates to specialists). These are critical to our success as engineers. If you have a desire to work in these fields, contact us or your retention noncommissioned officer or discuss it with your chain of command. We can help you make the transition to these fields! Any 62E10 or 62J10 who wants to attend Airborne School and enter the exciting life of a paratrooper should call us; we can help get you a school slot to get you on your way!

Also note that 100 percent strength does not mean that every position will be filled. We currently are required to fill recruiters, drill sergeants, and Active Component/Reserve Component (AC/RC) over the number of authorized positions for those organizations. When we fill those positions, other areas in the Army must go short.

Promotions

Promotion is a topic near and dear to everyone, and there are no new secrets here. However, there are MOSs where we are short NCOs at the sergeant and staff-sergeant levels. These are called STAR MOSs. This means that soldiers in the MOSs (shown by grade on page 33) will be promoted to sergeant after they complete the Primary Leadership Development Course and have their points validated. Soldiers may be promoted conditionally to staff sergeant when their points are validated, but they must complete the Basic Noncommissioned Officer Course within one year.

- Sergeant STAR MOSs: 00B, 51K, 51M, and 62H
- Staff sergeant STAR MOSs: 00B, 51M, and 52E

Leaders should look at this list closely. If you have soldiers in these MOSs who are eligible for promotion, any unnecessary delay in getting them to the board or school will delay their promotion. If they are not qualified for promotion, be specific in your counseling and give the soldiers concrete guidance on areas to improve for promotion. Advising them of this current situation could provide them the extra motivation to correct their deficiencies so they can get boarded, schooled, and promoted as soon as possible.

Assignment Priorities and Guidance

Man the force. Get divisions and armored cavalry regiments (ACRs) to 100 percent strength. This is the guidance we are following today as directed by the Chief of Staff of the Army. We currently have two categories for assignments: Fill Priority 1 and 2. Fill Priority 1 assignments are the divisions and ACRs, recruiters, drill sergeants, Army combat-training centers (National Training Center, Joint Readiness Training Center, and Combat Maneuver Training Center), AC/RC positions, and other joint-duty and high-priority assignments. The rest of the Army is Fill Priority 2. This means that we fill 100 percent of the positions in Fill Priority 1 units and fair share the remaining soldiers in Fill Priority 2 units.

Soldiers Needed!!!

We need soldiers for the following MOSs:

- 00B diver
- 52E prime-power-production specialist
- 81T topographic analyst
- 62E/J airborne-equipment operators

If you are interested, call us at commercial (703) 325-4824 or DSN 221-4824.

Call Us

Feel free to contact us, or your assignment personnel, with any questions. Remember that we can't help if we don't know there is a problem. And we surely can't send you to the assignment of your choice if you don't tell us what it is *before we make your next assignment.*

Lieutenant Colonel Luce is the Branch Chief for Engineer Enlisted Assignments.

(continued from page 31)

The Road Ahead

Validating the TBMP is an ongoing and evolutionary process. The main effort for both ROK and U.S. engineers over the next several months will be to implement the TBM2 to conduct detailed analyses on a wide range of dynamic float- and fixed-bridge employment schemes. We must integrate recent analyses of Korean roads, bridges, tunnels, and underground facilities to validate planning assumptions and enhance fixed-bridge repair and replacement strategies. Additionally, we must monitor bridge-modernization programs to explore and refine options to mitigate bridging shortfalls throughout the campaign.

Specifically, we must carefully evaluate the impact of the U.S. conversion to the multirole bridge company and the turn-in of ROK bridging stocks (M4T6 and CL 60) in future years. We must also assess older ROK and U.S. bridging stocks (like the M2 Bailey bridge) with respect to readiness, maintenance, and training to maximize LOC bridging capability, employment, and sustainment. Finally, we must determine the availability of potential bridging stock that is not currently allocated to this theater. This includes bridging stock in Sagami Depot, Japan; U.S. Army ribbon-bridge components throughout the Active and Reserve Components; and commercially available stocks such as the floating MGB and prefabricated modular steel bridges. Exploring these options will ensure optimal battlefield employment and management of military float and fixed bridging in the KTO.

LTC Donahue commands the 41st Engineer Battalion, 10th Mountain Division, Fort Drum, New York. Previously, he served as Chief, Studies & Analysis Branch, Plans Division, Assistant Chief of Staff, Engineer, Combined Forces Command, Seoul, Korea, as well as the Engineer Brigade S3 and 11th Engineer Battalion S3, 3d Infantry Division (Mech) at Fort Stewart, Georgia. A graduate of the Virginia Military Institute, LTC Donahue holds a master's in operations research from the Naval Postgraduate School and is a licensed professional engineer in Virginia.

Endnotes:

[1] Ambrose, Stephen, *Pegasus Bridge*, New York: Simon & Schuster Inc., 1988, p.10.

[2] FM 90-13/MCWP 3-17.1, *River-Crossing Operations*, Headquarters, Department of the Army/U.S. Marine Corps, 26 January 1998, pp. 1-1 and 1-3.

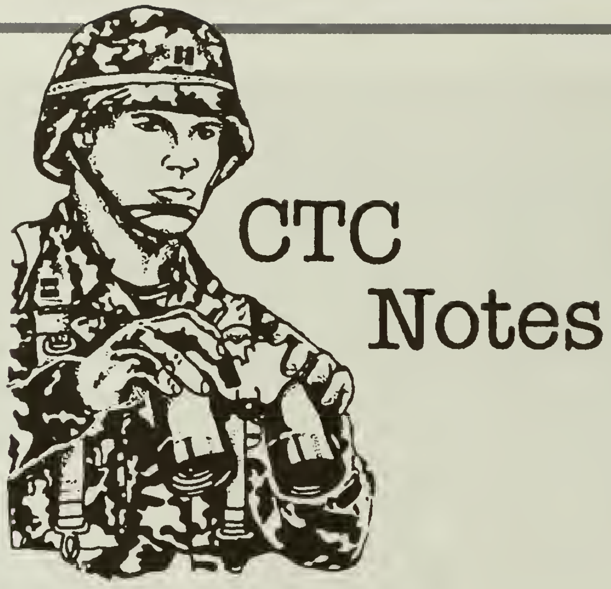
[3] Ibid., pp. C-9, C-10, and C-13.

[4] Ibid., p. 1-4.

[5] Ibid., p. 9-5.

[6] E-mail correspondence between Colonel John F. Troxell, Chief of Plans Division, CFC ACofS, Engineer, and Colonel Steven R. Hawkins, Chief of Staff 3d Infantry Division (Mech), on 30-31 July 1998, and Operation Joint Endeavor Bridging Research Analysis conducted by BRTC Technology Research Corporation, 15 July 1998.

[7] SIMUL8, Visual Thinking International, http://www.visualt.com.



Obstacle Numbering...Critical to Planning, Tracking, and Reporting

By Captain William G. Tennant and Lieutenant Colonel Thomas P. Smith

A common problem for engineer units training at the Combat Maneuver Training Center (CMTC) is visualizing the countermobility effort. Specifically, most units have poor tactics, techniques, and procedures (TTP) for planning, tracking, and reporting obstacles. Unit problems are compounded by a lack of familiarity with the doctrinal obstacle-numbering convention described in FM 20-32, *Mine/Countermine Operations*. They routinely use nonstandard numbering, resulting in confusion during planning, difficulty with tracking, and poor reporting of the countermobility effort. Used properly, the doctrinal 12-character obstacle-numbering system facilitates planning, tracking, and reporting of obstacle information.

FM 20-32 states, "The minefield/munition field obstacle-numbering system consists of 11 characters and 1 obstacle status symbol. It shows the type of obstacle, the belt and the zone in which it is located, and the headquarters that established the zone." All the information needed to plan, track, and report obstacles is present. Figure 1 is an example of the obstacle-numbering system.

The doctrinal numbering system corrects a unit tendency to treat obstacles like artillery targets. The "target" technique assigns a series of obstacle numbers to each emplacing unit. The problem with this technique is terrain visualization. Higher headquarters cannot readily associate the obstacle number with a location on the ground. The doctrinal numbering system provides terrain visualization by answering *where* (zone, belt, group), *what* (obstacle type), and the *status* (planned/, being prepared -, prepared + [for reserve obstacles], and complete **X**).

Units adapt the target technique because the doctrinal system appears to be complicated; however, the doctrinal system is deceptively simple. For example, at brigade level and below, the obstacle prefix (division-level headquarters) is the same for all obstacles. Similarly, task-force-level engineer effort is normally contained within one obstacle zone and sometimes within one obstacle belt. Therefore, the task-force tactical-operations center records the zone and belt for submitting reports to higher headquarters. Finally, the engineer platoon leader only tracks the belt and group. What initially appears to be a cumbersome numbering system gets progressively simpler at lower levels.

Another problem with tracking the countermobility effort is a tendency to track several distinct obstacles as a single obstacle. This oversimplification of the obstacle plan disregards the purpose of bottom-up refinement. For example, many units track a wire-mine-wire obstacle as a single obstacle rather than an obstacle group consisting of *wire, triple-standard* (WT)-*minefield, fix* (MF)-and *WT*. To clarify tracking and reporting, the platoon leader plans multiple obstacles in each group and assigns obstacle numbers. In doing so, he completes the planning process by providing bottom-up refinement. The result is a completed obstacle plan at the origination headquarters (Figure 2).

Proper use of the obstacle-numbering system is shown in Figures 2 and 3. A sketch of a block obstacle group (A1B) is shown in Figure 2. The group was planned at the task-force level. The platoon leader knows the obstacle intent and the general geographic location based on top-down planning. From detailed reconnaissance, he plans to complete this obstacle group with five individual obstacles: *wire, triple-standard* (WT01); *minefield, nuisance* (MQ02); *wire, triple-standard* (WT03); *minefield, nuisance* (MQ04); and *road crater, hasty* (RH05). The company tracks the obstacle group on an execution matrix (Figure 3).

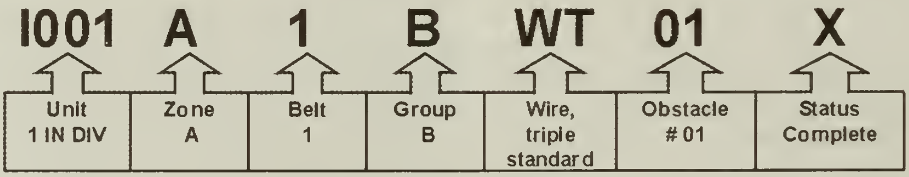


Figure 1. Obstacle Numbering

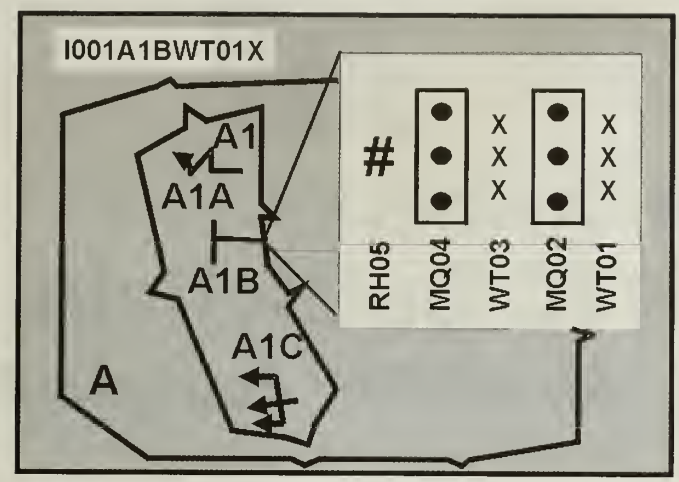


Figure 2. Obstacle Planning

Zone/Belt/ Group/ Obstacle Number	Location	Effect	Priority	Emplacing Unit	Owning Unit	Lane Location	Lane Closure* Responsibility	Materials/Assets Required	Materials Location	Special Instructions
I001A1BWT01X	QV05505925	Block	1	1/A/23EN	A/1-76 AR	NA	NA	Kit 1	CLIV/V #1	
I001A1BMQ02-	QV05435923	Block	2	1/A/23EN	A/1-76 AR	NA	NA	Kit 3	CLIV/V #1	
I001A1BWT03/	QV05315921	Block	3	1/A/23EN	A/1-76 AR	NA	NA	Kit 1	CLIV/V #1	
I001A1BMQ04/	QV05255920	Block	4	1/A/23EN	A/1-76 AR	NA	NA	Kit 3	CLIV/V #1	
I001A1BRH05/	QV05125917	Block	5	1/A/23EN	A/1-76 AR	NA	NA	Kit 5	CLIV/V #1	

*Reference to reserve-obstacle execution matrix

Figure 3. Directed-Obstacle Execution Matrix (from FM 90-7, Figure 5-1)

The platoon leader uses the same matrix as an execution-and-report matrix. For example, assume the first obstacle is complete (A1BWT01X). The platoon leader reports "A1BMQ02-" when beginning the second obstacle. Upon completion, the report becomes A1BMQ02X. The company then reports to higher headquarters on the status of the group. Since Group A1B consists of five obstacles and two of the five obstacles are complete, the status report is "Group A1B 40 percent complete." The zone-belt designation is nearly transparent at the platoon level but easily used at higher levels for visualization of the countermobility effort.

Using the proper numbering convention facilitates top-down planning and bottom-up refinement. It helps subordinate units refine the plan and send information to higher headquarters. The numbering system feeds directly into a tracking system and prompts leaders on the ground to send reports. A clear understanding of the doctrinal numbering system will help alleviate problems with obstacle planning, tracking, and reporting.

Captain Tennant, a brigade engineer observer/controller at the CMTC, was previously a platoon leader and XO, 16th Engineer Battalion (Corps Mech), in Bamberg, Germany and Bosnia. He also commanded C/326 Engineer Battalion, Fort Campbell, Kentucky.

Lieutenant Colonel Smith, the senior engineer observer/controller at the CMTC, was previously the executive officer for the 54th Engineer Battalion, Bamberg, Germany.

Engineer Success on the JRTC Battlefield:

An OPFOR Engineer Perspective

By Captain James S. Matthews

Serving as the Opposing Force (OPFOR) task-force engineer for 18 rotations at the Joint Readiness Training Center (JRTC), Fort Polk, Louisiana, provided key insight on how successful engineer operations allow a brigade-plus organization to accomplish a wartime mission. Each year, 10 light infantry brigades came to JRTC to participate in one of the most realistic combat-training exercises in the U.S. military. Brigade commanders are expected to accomplish the given mission while leading 6,000 soldiers, dealing with the challenge of a role-playing civilian populace and news media and, of course, conducting combat operations against the insurgent and invading forces of Cortina, a fictitious country developed by the staff at JRTC. An important lesson learned by each brigade is the importance of mobility, countermobilty, and survivability operations to mission accomplishment.

Engineers preparing to enter Cortina need to understand a few important concepts to enjoy success on this light battlefield. First, they must understand the strengths and weaknesses of the OPFOR. Second, a Blue Force (BLUFOR) unit must secure and guard an OPFOR obstacle once it is encountered. Third, and most important, securing the breach site is the key to a successful breach on the JRTC battlefield.

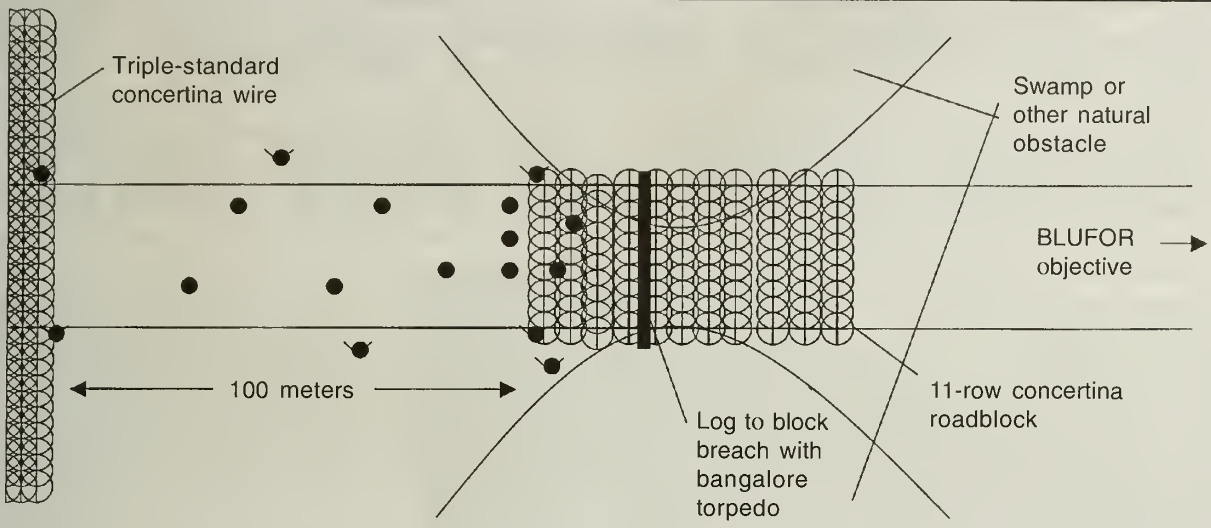
Understand OPFOR Strengths and Weaknesses

The OPFOR at JRTC has many strengths and weaknesses that differ from U.S. units. The forces of Cortina do not have the resources on which U.S. soldiers rely. The enemy soldiers are forced to substitute ingenuity and tenacity to compensate for this lack of resources. Success can be gained by understanding the strengths and weaknesses of this enemy.

OPFOR Class IV and V supplies are very limited for countermobility operations. An S2 can analyze the known enemy obstacle on the ground against the templated Class IV and V resources to determine future countermobility capability. The typical complex obstacle found in Cortina during a People's Democratic Republic of Atlantica (PDRA) defense contains 40 rolls of wire and 15 mines (see figure on page 37).

The TM-62 is used in probable breach points due to the effectiveness allowed by its fuse. Although there are many variants, the version of the TM-62 portrayed at JRTC has a seismic, magnetic, and pressure fuse. It is the antitank (AT) mine preferred by OPFOR soldiers on the ground. The box mines (YAM-5 and TMB-D) are not as effective, and they are difficult to bury properly because of their large size and rectangular shape. The AT mines will be reinforced and protected by antipersonnel (AP) mines, typically OZM-3s, either placed on the flanks or tied in to the wire obstacle (very effective method). Air-delivered scatterable mines can be used by the PDRA. The system requires multiple passes from the MI-17 HIP (helicopter) for emplacement. This platform is extremely vulnerable to U.S. Army air-defense-artillery assets and is not as capable as an air Volcano for seeding a large area (only 200 by 100 meters).

The OPFOR in Cortina has a very limited amount of combat power to maneuver against the enemy. The Cortina Liberation Front typically fields about 150 soldiers during the low-intensity conflict. The PDRA will have less than 250 soldiers and a small mechanized counterattack force during defensive operations. The importance of these numbers to the task-force engineer is the limited number of troops providing security at the obstacles. A platoon or less will provide cover and observation for a major tactical obstacle. The OPFOR infantry has very few transportation assets and therefore a limited ability to move forces quickly in the area of operations. The tanks and Soviet mechanized infantry vehicles (BMPs) can move quickly to provide supporting fires, but once they have started their engines, it is only a matter of time before OH-58 helicopters or AC-130 aircraft will find them by their thermal image. Therefore, the OPFOR commander will only bring mechanized forces out of hide sites when he sees that the situation is urgent and is willing to risk those assets. One important method the OPFOR uses to make up for a lack of troops is employing the Leesville Urban Group (LUG). These terrorists in civilian clothes and long hair blend with the population to provide intelligence on BLUFOR activities. They routinely infiltrate a U.S. perimeter under some false pretense of making site sketches to post in the Cortina Liberation Front's tactical-operations center. They will also be called on to execute offensive terrorist operations such as ruck bombs, truck bombs, sniper attacks, and ambushes.


Triple-standard concertina wire
Swamp or other natural obstacle
BLUFOR objective
100 meters
Log to block breach with bangalore torpedo
11-row concertina roadblock

- The first wire obstacle is more than 100 meters from the second to avoid being breached by a single MICLIC.
- AP mines are tied to the wire and placed on flanks to stop dismounted forces.
- A series of AT mines is placed in a row to defeat a roller or plow by causing multiple hits in the same spot.
- All wire is tied with barbed wire on the top with 6-inch ties.
- The separations between the sets of wire allow vehicles to be trapped.
- Mines are placed in the wire to stop a charging M1 tank. A damaged or destroyed heavy tank in the wire is an extremely effective obstacle.
- A log is placed between rows 4 and 5 to block the breach with a bangalore torpedo.

Typical complex obstacle used by the PDRA during the defense

OPFOR indirect-fire assets used against breaching forces are also at risk. Mortar teams have to displace quickly to avoid counterfire (typically 4 minutes or less). Artillery acquired by the AN/TPQ-36 Fire-Finder Radar System will usually receive counterfire before it can displace. The OPFOR will have soldiers or terrorists from the LUGs that report the direction of the AN/TPQ-36. The task-force engineer should ensure that his soldiers are receiving radar coverage during breaching operations. When covered by the AN/TPQ-36, the OPFOR's willingness to fire on a breach point will be affected. The obstacle will be tied in to the terrain (usually water or a swamp) and covered by 82-millimeter mortar, if not by artillery or rocket fire.

BLUFOR engineers preparing for the defense need to understand the mobility of the OPFOR while fighting as the PDRA. The day before the attack, division recon units travel the planned mechanized attack routes to report obstacle construction and disposition of BLUFOR troops. They are followed by the brigade recon to give an updated status. Both recon forces avoid contact unless a high-payoff target presents itself (parked Volcanoes are a favorite). Light forces begin marching the night before the attack, clearing the route with attached sappers and killing the BLUFOR securing the route.

Important targets for the dismounted forces are Volcanoes, Modular Pack Mine Systems (MOPMS), and Hornets that have yet to be employed. The BLUFOR typically do not employ these systems more than 4 hours before the attack due to the short-duration destruction times. Dismounted forces that find and destroy these assets before they are activated avoid a tactical breach, which makes it difficult for the BLUFOR to fill the gap before the main effort arrives. OPFOR companies on the dismounted routes leave a soldier at each point of breach to ensure that the mechanized attack finds the lane and passes through the obstacle. The mechanized attack launches at first light on the morning of the attack. The OPFOR is prepared to shift its main effort minutes before rollout.

The mobility of the T-62s is an important factor to consider when preparing an obstacle plan. The OPFOR mechanized troop is accustomed to travelling through the swamps. Do not expect them to follow the road or well-established trails. They regularly surprise U.S. forces by emerging from the wood line at a high rate of speed, at times within the arming range of a tube-launched, optically tracked, wire-guided (TOW) missile. They also are not afraid of the poor traction in the lowlands. During some rotations, the OPFOR loses more tracks by getting stuck in the mud than from enemy fire. By moving through these unexpected avenues of approach, they are able to appear at the brigade support area or tactical-operations center with few casualties. Some T-62s are equipped with a mine-clearing plow. This is an important fact to remember when templating a scatterable minefield. The low density of AT mines in scatterable minefields makes them an easy breach for mechanized forces trained in proper plow techniques. The mechanized attack has several plow tanks that are proficient in the breaching drill.

Secure OPFOR Obstacles

The BLUFOR must secure the area around an OPFOR obstacle once it is encountered on the JRTC battlefield. The OPFOR uses an obstacle as a choke point to commit its limited forces. The PDRA commander often launches his limited mechanized assets or even moves infantry to capitalize on BLUFOR preoccupied with beaching operations. Many times BLUFOR troops encounter an obstacle and either fail to report its location or their report is ignored. These mistakes cause other BLUFOR vehicles to be involved in mine strikes or an ambush.

The engineer company needs to identify, mark, and breach each obstacle. In addition, the obstacle needs continued observation and clearing to protect against reseeding of the minefield. OPFOR soldiers will place an additional mine at the end of a breach lane to produce casualties and weaken the BLUFOR's confidence in the routes. Any minefield that is cleared and then left unsecure will have the same wire strung back across the road. Mines taken from a local cache are also emplaced. If a minefield is not to be completely cleared, the cleared lane needs to be marked with a system that will withstand heavy military traffic and forces civilian traffic to drive only through the cleared lane.

Concertina wire that funnels the traffic is a proven technique. Any marking system that allows a driver to stray from the lane, go around the marking system, or knock down the markers will lead to BLUFOR casualties. In addition, Cortinian natives who were not briefed on a lane-marking system will also use the breach lane during their daily travels. A destroyed civilian vehicle in a BLUFOR-controlled obstacle does not look good on the national newscast.

Secure the Breach Site

Securing the operation site is the key to a successful breach on the JRTC battlefield. The other breaching fundamentals—suppress, obscure, reduce and secure—must also be completed to standard, but the enemy's eyes on the obstacle are his strength. Properly securing the obstacle will prevent the OPFOR from observing the attacking BLUFOR and calling observed indirect fire.

Suppress. Suppression of the target is most effectively executed by using indirect fire. The OPFOR providing security of the obstacle will not show itself when presented with an organized breach force. This makes direct-fire suppression very difficult. The OPFOR remains in the vegetation and interdicts the enemy using its own indirect assets (primarily 82-millimeter mortars). In addition, small-arms direct-fire engagements typically come out in the OPFOR's favor.

Obscure. Obscuration of the obstacle reduces the number of direct-fire casualties but will not eliminate casualties due to indirect fire. Keeping in mind the small size of the typical obstacle emplaced by Cortinian forces, obscuring the exact location of soldiers is not sufficient to save them from mortar rounds. The OPFOR commander will direct his troops to have a 10-digit grid coordinate for the obstacle and probable breach points. The blast radius of an 82-millimeter mortar or a 152-millimeter artillery round will affect the engineers in and around the wire. Coordinate with the chemical units or fire-support officer to assure that the smoke will arrive on time and on target.

Reduce. Reduction of the obstacle needs to be executed quickly. All mines are subsurface unless placed on a hardball road. Do not attempt to remove the mines from the route. The seismic fuse on the TM-62 will kill anyone who attempts to remove it. Be aware of OZM-3 trip wires while approaching and cutting the concertina. The OPFOR in the defense shifts forces to affect BLUFOR troops during a breach. The force augmentation could range from a few scouts to a tank-BMP team. Moving BLUFOR forces through the breach allows them to fight in an open area past the obstacle and out of the planned engagement area.

Secure. Securing the operation site is the key to a successful breach on the JRTC battlefield. The small number of OPFOR soldiers providing observation on the obstacle demonstrates that indirect fire is the key to obstacles in Cortina. The first rounds cause casualties and begin the casualty-evacuation process. Each successive wave of BLUFOR trying to breach and rescue fallen comrades only adds to the pain of the process. Infantry forces must secure the point of breach and clear the surrounding area through occupation before the obstacle can be reduced. Searching the immediate area flushes out OPFOR and identifies hide sites. Once the immediate area is secured, the surrounding terrain needs to be swept to ensure that OPFOR scouts are not waiting to call a fire mission. Removing OPFOR eyes from the obstacle makes the reduction an easy battle drill.

Conclusion

Engineers who heed these suggestions will be more successful both on the JRTC battlefield and in light conflicts. Remember to know and understand the OPFOR. Locate the obstacle, secure the site, and remain in control of the area after the breach. This knowledge will allow the most intelligent use of engineer forces in the breach and the defense, greatly improve the BLUFOR's performance, and produce a better-trained and -prepared force.

Captain Matthews is the S4 of the 27th Engineer Battalion (ABN), Fort Bragg, North Carolina. He was previously the OPFOR task-force engineer, 1/509 Infantry (ABN), at the JRTC; assistant operations officer, HHC/ 20th Engineer Brigade (ABN), Fort Bragg; and vertical platoon leader, Fort Polk. CPT Matthews holds a bachelor of science degree in civil engineering from the Georgia Institute of Technology and is a graduate of the Airborne, Jumpmaster, and Ranger Schools. He is a professional engineer in Missouri.

West Point Cadets Train With the 416th ENCOM

By Colonel Robert Phillips

A cadet operates a vibratory roller at the Manchester Road project site.

Traditionally West Point cadets are assigned to active Army units for their cadet troop-leader training (CTLT). However, this year two cadets completed their troop-leader training with Army Reserve engineer units that were on annual training in an installation-related construction mission at Fort Dix, New Jersey. According to the academy's Engineer Branch representative for the Department of Military Instruction, this year's Reserve Component CTLT with the 416th Engineer Command (ENCOM), headquartered in Darien, Illinois, was a first for the United States Military Academy.

After arriving at Fort Dix on 10 July 2000, the cadets were assigned to companies of the 458th Engineer Battalion (Combat) (Wheeled). The cadets gave classes on troop-leading procedures and the proper placement of obstacles to deter an enemy. They led squads on ambushes, helped run several weapons ranges, participated in demolition training, and learned to deploy bangalore torpedoes. The cadets also took part in the unit's 72-hour Sapper Stakes tactical operation against an opposing force. The executive officer of the 458th Engineer Battalion stated that the cadets worked hard and had fun but did not hesitate to ask questions, especially concerning platoon-sergeant and platoon-leader responsibilities.

During the second half of their CTLT rotation, the cadets were assigned to the 365th Engineer Battalion (Combat) (Heavy). One cadet led the horizontal platoon for A Company and was designated the officer in charge of the Manchester Road resurfacing project. In addition to his supervisory duties, he was given the opportunity to operate some road-construction equipment. As platoon leader, he attended battalion staff meetings and briefed his platoon's progress. By training with Army Reserve units, he learned that troop leading is the same whether working with active or reserve personnel. After completing his CTLT rotation, he decided that his branch of choice would be engineer.

The second cadet was assigned to the equipment platoon of the battalion's Headquarters and Headquarters Company during the second half of the training period and supervised his platoon's construction of a helicopter gunnery staging area. He attended battalion staff meetings to brief the progress of his platoon's project and served as an assistant range officer for the rifle and .50-caliber ranges. Believing that the training was one of the more interesting experiences he had had in the military, the cadet recommended that the Academy send more cadets to participate in annual training with Reserve units.

The two cadets were pleased with their Reserve Component CTLT rotations. They especially appreciated being given an opportunity to train in two different types of engineer battalions. Serving in both combat-heavy and combat-wheeled units gave them a broader training experience in engineer operations. A spokesman for the 416th ENCOM observed that the two cadets received training time equal to the West Point cadets he sponsored while on active duty. He explained that Reserve units are out in the field the majority of the time while on annual training in order to maximize their training opportunities, while the cadets he sponsored on active duty spent much of their time in garrison and not in the field on engineer missions.

Within the past few years, the term "seamless Army" has been replaced by "the Army," connoting that the active Army, the United States Army Reserve, and the Army National Guard are all partners in the total-force concept. The 416th ENCOM's participation in the United States Military Academy's CTLT program is but another example of the relevancy of the Reserve Components in the Army.

Colonel Phillips, a comptroller in the 416th ENCOM, has over 29 years of commissioned service. A graduate of the Judge Advocate General's School and the Judge Advocate General's Officer Advanced Course, he holds degrees from Indiana University and the DePaul University College of Law, Chicago.

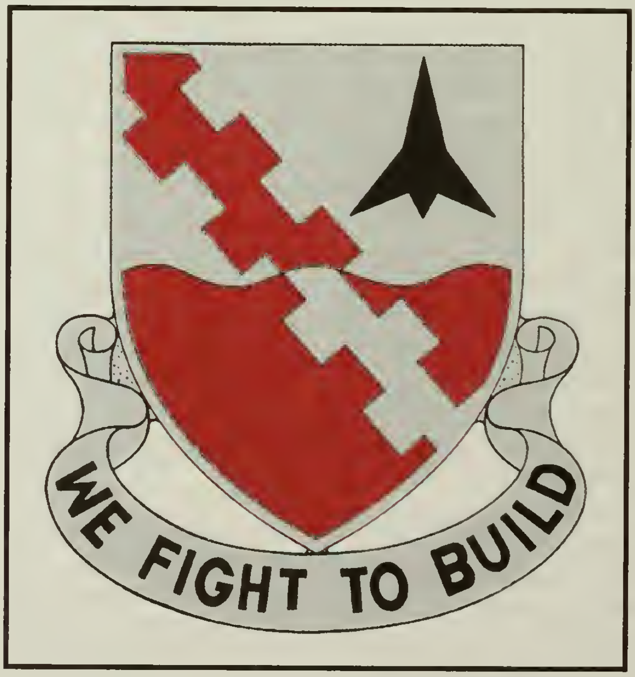
UNIT HISTORY: A TWO-EDGED SWORD

By Dr. Larry Roberts

This article is reprinted from the April 1994 issue of Engineer.

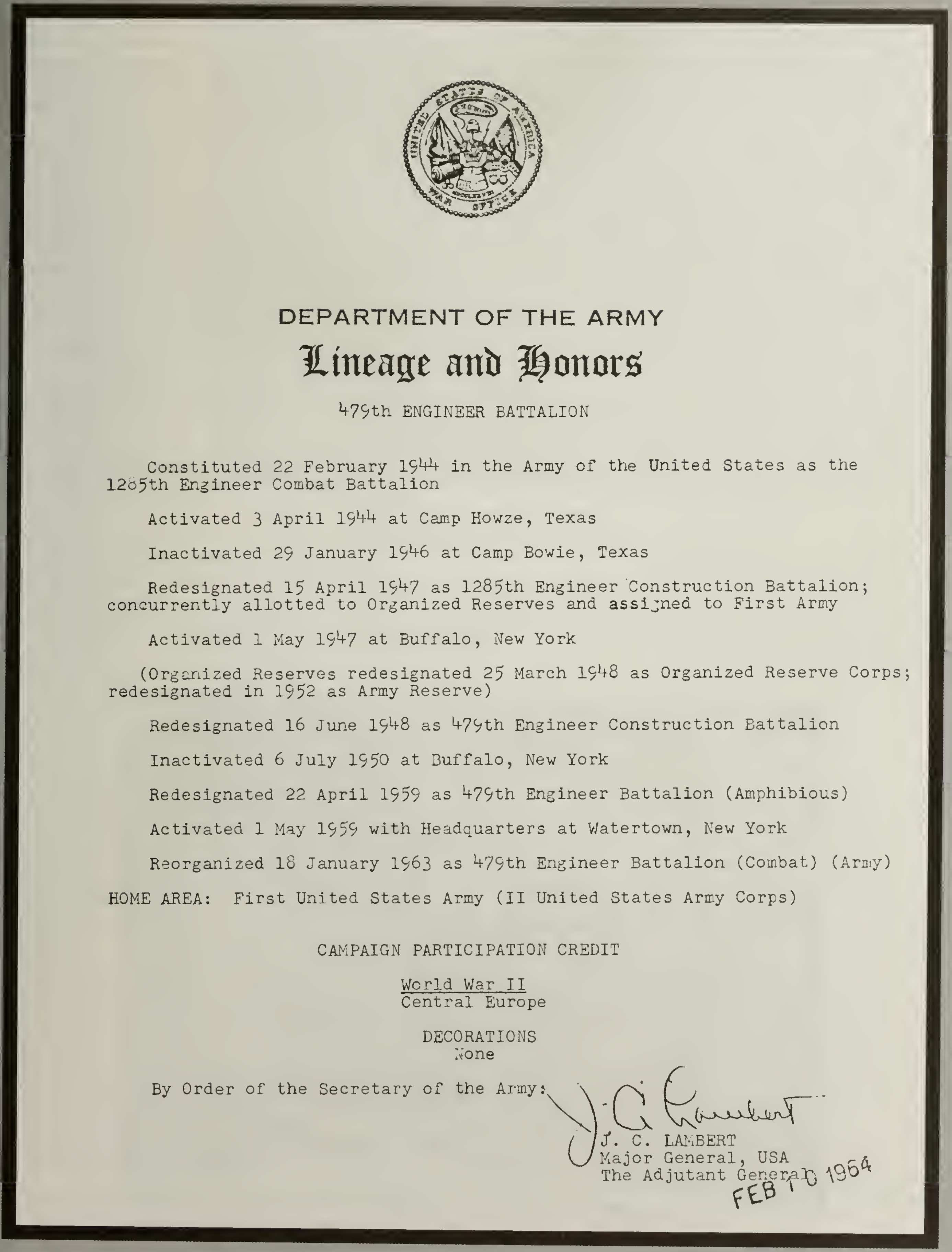
In more than one instance, young officers have walked into the History Office at the Engineer School with the mission of writing a history of their unit. Usually, the task was given to them by a battalion commander who wanted something for new soldiers to read. The obvious purpose of such a document is to instill a sense of pride in the unit, fostering unit morale and esprit de corps. This is the traditional view of unit history. It is the reason units are allowed to maintain an organizational history file within the Modern Army Recordkeeping System (MARKS). However, that file—and unit history in general—can actually serve the unit commander in two ways: It can enhance unit morale and esprit de corps and provide information for command decision making. This is possible only if there is command emphasis.

Few of those young officers who entered my office knew of a unit history file. Once informed of its possible existence, they went to it and often found little of value to their task. Unit history files run the gamut from little or nothing (except for last year's annual history report) to a collection of random newspaper clippings, change-of-command brochures, and pictures of changes of command and organizational-day activities. While these later items have merit, they do not completely document the unit's accomplishments in war or peace. Invariably, those same officers returned to my office in search of more information. They ultimately learned that gathering material on their units is a slow process that involves working with a number of federal organizations. However, with patience and determination, they can get what they need.



Unit crest of the 479th Engineer Battalion

Before contacting federal organizations for information, the unit historian should examine the unit's lineage and honors (see page 41), often found in the commander's office. This will save a lot of time. The lineage and honors details the unit's federal service and identifies the various campaigns for which the organization has service credit. By knowing the periods of federal service, the action officer can disregard those conflicts during which the unit was inactive. The lineage and honors also identifies parent organizations. Their files and histories are logically a part of the heritage of the unit and should be examined as well. The campaign credits tell the researcher where the unit served. Campaign credits for the Pacific in World War II means that the officer can ignore the European theater when doing work in published historical works. After reviewing the lineage and honors, the action officer can begin contacting other organizations for additional information.



DEPARTMENT OF THE ARMY

Lineage and Honors

479th ENGINEER BATTALION

Constituted 22 February 1944 in the Army of the United States as the 1285th Engineer Combat Battalion

Activated 3 April 1944 at Camp Howze, Texas

Inactivated 29 January 1946 at Camp Bowie, Texas

Redesignated 15 April 1947 as 1285th Engineer Construction Battalion; concurrently allotted to Organized Reserves and assigned to First Army

Activated 1 May 1947 at Buffalo, New York

(Organized Reserves redesignated 25 March 1948 as Organized Reserve Corps; redesignated in 1952 as Army Reserve)

Redesignated 16 June 1948 as 479th Engineer Construction Battalion

Inactivated 6 July 1950 at Buffalo, New York

Redesignated 22 April 1959 as 479th Engineer Battalion (Amphibious)

Activated 1 May 1959 with Headquarters at Watertown, New York

Reorganized 18 January 1963 as 479th Engineer Battalion (Combat) (Army)

HOME AREA: First United States Army (II United States Army Corps)

CAMPAIGN PARTICIPATION CREDIT

World War II
Central Europe

DECORATIONS
None

By Order of the Secretary of the Army:

J. C. Lambert
J. C. LAMBERT
Major General, USA
The Adjutant General

FEB 10 1964

There are a number of sources of unit history. The National Archives in Washington, D.C., contains unit files for hundreds of organizations, especially for the years of World Wars I and II and the Korean and Vietnam Wars. The major disadvantage of using the Archives is the cost charged to reproduce the files. A unit that chooses to purchase complete files normally finds copies of material (such as unit orders and correspondence) that have little merit for a written history. However, scanning the files to sort out the unwanted material requires a trip to the Archives, something few units can afford. One of the best approaches is to contact friends or associates in the Washington area and ask them to spend a couple of hours in the Archives.

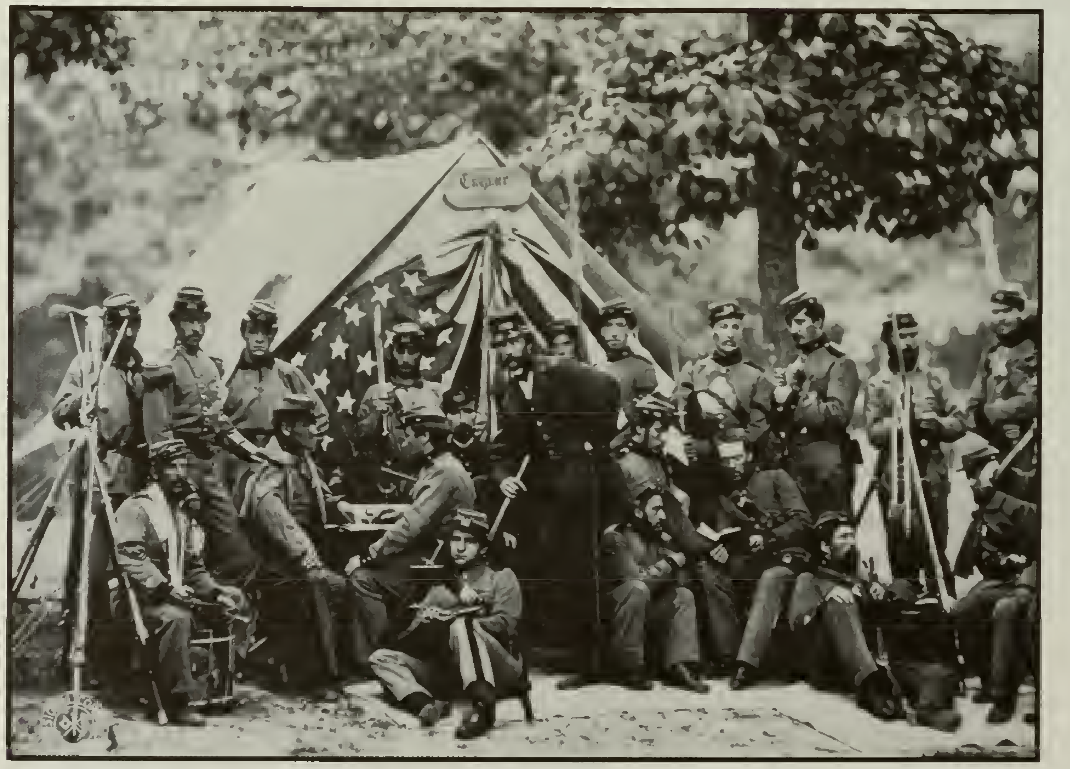
Other information can be found in written histories, such as the official history of World War II published by the Center of Military History, Washington, D.C., or books written by participants. Some material can be found in publications such as the *Stars and Stripes* and *Yank* magazines. Command newsletters, such as the *Castle Courier* (the newsletter of the engineer command in Vietnam), are excellent sources for units that served in Southeast Asia. Often, the Military History Institute at Carlisle Barracks, Pennsylvania, is the best single source for much of this type of publication. *Military Engineer* and *Engineer*, the professional bulletin of Army engineers, have traditionally published articles on unit activities. The Defense Technical Information Center (DTIC) has some of the quarterly reports (lessons learned) written by engineer units in Vietnam. Many Army libraries have access to DTIC and can order these reports.

The History Office, Office of the Chief of Engineers, at Alexandria, Virginia, has an extensive unit-history collection. A master index for each unit identifies what type of material is present, including oral interviews with senior engineer officers. In addition, a call or note to the Organizational History Branch of the Center of Military History can produce information on the unit's history and the symbology of the organization's crest or distinctive unit insignia.

While the Engineer School at Fort Leonard Wood has been slowly collecting unit material, there is much we do not have. A call or note would determine what is available. Again, with patience and determination, enough material can be collected to write a unit history that is useful in telling new soldiers a story of challenges and accomplishments.

That story normally deals with operations in war because most of the information found in the Archives, Carlisle Barracks, and other places deals with units in war. While that is important, combat constitutes only a small part of any unit's overall history. A greater amount of time is spent in peacetime and involves the countless challenges and requirements of an Army not at war.

Ironically, the unit's efforts in peacetime in such areas as training can provide the second important benefit of unit history and the organizational history file—support for decision making. Unit commanders face numerous challenges over the course of their command. Requirements for maintenance, training, and post and family support compete for attention and resources. This is not new. Peacetime is traditionally the most demanding period for an army because resources are scarce



This historical photo of the 8th New York State Militia is an example of recording unit history.

This photograph, taken by CPT Dunham of the 43rd Engineer Battalion, Fort Benning, Georgia, shows humor in recording his unit's history.

and requirements are not. The knowledge of how one's predecessors handled these conflicting demands would benefit any commander.

For example, if after-action reports from unit field training exercises (to include those at the National Training Center) were maintained over time, the current command could identify areas of consistent strength or weakness. When coupled with completion reports of construction projects, post-support detail summaries, etc., new commanders would know quickly what challenges to expect. Copies of annual organizational inspections, especially in the areas of maintenance, would reveal the impact of these demands on the readiness of equipment, unit morale, and soldier support.

Many of these reports are found in other files in the headquarters, such as the S3 and S4 files. However, these items normally have a comparatively short file life. Regulatory requirements to retire certain files after a cutoff date, and the simple need for file space, normally account for the demise of historically significant documents. By contrast, the Organizational History File, MARKS number 870-5a, is a permanent file. Regardless of who maintains the file, it exists as long as the unit does. Therefore, the material placed in that file will always be available to commanders or their staffs.

Some may consider it strange to put a command-inspection report or a field exercise after-action report in a "history" file. That is because too many believe that history is what happened 20 or 30 years ago. In fact, yesterday is history; it has happened and cannot be changed. The material placed in the historical file today becomes the historical material for all who serve in the unit in the future. Invariably, the value of that file is driven by the quality of material placed in it.

One of the most important items that could be placed in the file is the commander's review and assessment of activities. Virtually every unit is required to produce some form of annual historical report. Often, these documents are of marginal value, being only copies of last year's input with the names, statistics, and dates changed. However, this report could be invaluable if seen in the context of what was done, why, how, and the lessons learned from the effort. An annual—or even more frequent—summary of what the unit did, what initiatives were taken, and what worked or did not work would be extremely useful to future unit leaders.

In the past, end-of-tour reports were common for many unit commanders and key personnel. Today, we tend to limit that type of report to general officers. However, there is no reason why key officers and NCOs in a command should not write such a report. Not only would it be valuable in the unit history effort, but it would also be useful in providing perspectives and insights gained during service with the unit.

History is valuable to the profession of arms. Many famous leaders have attested to the value of applying the lessons of the past to the challenges of the present. The knowledge and appreciation of a unit's accomplishments are important in building and sustaining esprit de corps. Soldiers are challenged to maintain the traditions and standards of those who came before them. However, the raw materials of a unit history—the reports and papers that document what happened and why—can also be used to help current leaders guide their soldiers through the demands of today. Maintaining a viable unit-history file will serve all those who follow.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

NTC:

Lessons Learned From My First Rotation

By Second Lieutenant Steven L. Kreh

Throughout the Engineer Officer Basic Course and other training, I was told to prepare for anything once I arrived at my permanent duty station. Fortunately, I landed in an excellent position to learn how to be a platoon leader. After 3 weeks with my new company, I had the opportunity to go to the National Training Center (NTC) at Fort Irwin, California, where I was a liaison officer to a light engineer attachment. This position gave me time to observe platoon leaders and learn from their mistakes and successes. I learned several lessons from the operations in this training environment that will help me become a better platoon leader: how to develop and execute a well-rehearsed plan, remain flexible at the platoon level, and issue a proper operations order (OPORD) for each mission.

Soldiers train in the National Training Center desert.

Developing and Executing a Plan

A well-rehearsed plan is a key ingredient in conducting a successful operation. The main problem within the light engineer attachment was indecisiveness regarding the location of obstacles and fighting positions. This created several problems for the engineer platoon personnel because they needed to know the general location of an obstacle before any work could begin. If the platoon leader could not site in the obstacle, then the platoon could not begin to work on the obstacle. This pushed back the timeline and made it next to impossible for the engineers to execute all the planned obstacles.

What seemed to work best during the wargaming process was a thorough plan that provided the task-force engineer knowledge of where his soldiers could work as soon as they hit the ground. Planning allowed time for the squad leaders to conduct precombat checks (PCCs) and rehearsals for the upcoming missions. When the company team conducted a proper rehearsal, the unit fought well, and the soldiers all knew their roles. If engineers are given a plan that the task force fully develops and adheres to, they can conduct proper rehearsals and PCCs to ensure that they increase productivity to their highest level.

(continued on page 46)

Engineer Safety

Space Heater Safety

By Fred Fanning

Each winter, soldiers are injured by improper use of space heaters. The key to preventing these injuries is a unit program that identifies the hazards associated with the specific space heaters the unit uses and the implementation of procedures that will reduce or eliminate the hazards. However, this program is only effective if the procedures are actually implemented.

Improper operation of space heaters is normally at the root of the problem. Proper operation begins by identifying a soldier to operate the heater, followed by heater-specific training that results in licensing the soldier. AR 600-55, *The Army Driver and Operator Standardization Program*, provides guidance on selecting, training, and licensing heater operators. Unit personnel use the appropriate technical manual for the heater to develop lesson plans for the training. A hands-on performance evaluation is the best way to determine the skill level before licensing.

Table 1 lists the most common contributing factors to space-heater accidents. In reading through the list, it becomes apparent that if the soldier is properly selected, trained, and licensed, many of these factors can be avoided. Adding proper supervision to the program not only will ensure that the operator is trained and licensed but also will identify and correct hazards with the heaters, their fuel, and their use. Table 2, page 46, provides a list of measures that unit leaders can use to control or eliminate the hazards.

Various types of space heaters are used. The best types are the Army type-classified heaters, with laboratory evaluations and technical manuals to assist units in their use. Space heaters that use fossil fuels should always be vented outside the space being used or potentially being used by personnel. This limits their exposure to carbon monoxide gas, which is colorless and tasteless and normally cannot be detected by personnel. It is key to limit or prevent exposure to this gas.

Risk management should also be a part of the safety program. This process is best implemented by leaders to ensure that control measures are used and that hazard and control-measure information is passed on to soldiers who will be exposed to the hazards of operating space heaters.

Through the proper application of a space-heater safety program, leaders can control and eliminate the hazards faced by their soldiers. This program will enhance a unit's ability to conduct missions by preventing burns or deaths to soldiers and fire damage that often destroys equipment. A winter-weather alert for leader use can be found under the winter-hazard section of the U.S. Army Maneuver Support Center Safety Office home page at *www.wood.army.mil/safety/*.

Mr. Fanning is the Maneuver Support Center safety director.

Table 1. Contributing Factors to Space-Heater Accidents

- Failing to train personnel to operate space heaters.
- Using the wrong type of fuel.
- Placing clothing, tent materials, and other items too close to heaters and stovepipes.
- Storing flammables and ammunition/explosives inside tents.
- Refueling heaters before they have cooled.
- Leaving heaters unattended while operating.
- Maintaining heater units improperly.
- Failing to establish emergency procedures and make available and maintain fire-fighting equipment.

Table 2. Control Measures to Reduce Space-Heater Accidents

- Train personnel to operate space heaters safely and according to AR 600-55.
- Ensure that the proper type of fuel is used. Label the fuel container according to its contents. Refer to the operator or technical manual for recommended fuel.
- Keep clothes (wet or dry) at least 24 inches away from heating sources.
- Place tent stoves on a noncombustible base and surround them by a sandbox no smaller than 36 by 36 by 4 inches when sand and wooden construction materials are available. Install tent stoves at least 4 feet from tent walls. Keep tent flaps and ties near the stove opening away from the stovepipe.
- Place fuel containers at least 5 feet from the outside wall of the tent. Dike the containers to prevent fuel from spreading to space heaters.
- Avoid storing ammunition, combustible and corrosive materials, explosives, pyrotechnics, and simulators in tents with stoves or other heating sources.
- Turn off space heaters and allow them to cool for at least 30 minutes before refueling.
- Use only heaters with a ventilation system that is compatible with shielded tent-vent-stack openings. Extend at least two pipe sections above a tent peak. Keep a 2-inch ventilation space between the exhaust pipe and the tent.
- Designate a fire guard for each tent or a group of tents and brief him on his responsibilities and procedures.
- Check heating units (including fuel lines and connections) daily for leaks and malfunctions. Allow only qualified maintenance personnel to make repairs. Turn in equipment through supply channels when maintenance personnel are unable to repair.
- Develop and implement a field fire-alarm system. Make available a fire extinguisher, shovel, and ax at selected fire points. Provide at least one 10-pound dry chemical and water extinguisher per general-purpose (GP), medium tent and one pressurized water extinguisher for a GP, small tent. Ensure that all fire extinguishers are in operating condition. Ensure that all water fire extinguishers are winterized before using in winter months.

(continued from page 44)

Remaining Flexible

Flexibility gives a leader the opportunity to adjust to the changing environment of a battle. When the task force carefully planned where to put every obstacle in a defense at the NTC, that location would change once the engineer platoon leader conducted his reconnaissance and noticed a better location for the obstacle. For this reason, flexibility became extremely important in every successful mission.

Another example of flexibility being key was the location and utilization of obstacle-construction materials, referred to as Class IV. The task force never properly planned or executed a Class IV point, which meant that the engineers could not rely on the materials being where they were needed. The platoon leader had to remain flexible and adjust his plan so his soldiers could transport the materials to where he needed them. A mission will never go exactly as planned, no matter how much preparation is put into it, but this does not mean that a unit should disregard planning altogether. When the task force develops a thorough plan, the unit can react quickly when things do not go according to the plan. As long as platoon leaders remain flexible, they can adjust to ensure that they meet their commander's intent.

Issuing OPORDs

The commander's intent defines what a successful mission entails, and it comes from an OPORD. Although it takes some time to prepare, an OPORD provides all the information needed to conduct a mission. Without this knowledge, a platoon leader cannot expect his subordinate leaders to understand a mission thoroughly. Too often, soldiers—to include the squad leaders—are not informed regarding mission specifics because they have not received a proper OPORD. If a platoon leader does not properly give an OPORD to his platoon, they must work without any knowledge of why they are performing that mission.

Conclusion

A well-rehearsed plan, flexibility, and a proper OPORD are essential to the success of a platoon. Without these key elements, a platoon cannot execute all of its missions efficiently. These elements are critical to a platoon's functioning despite operating in the confusing and constantly changing environment of war. The NTC allows soldiers to train under conditions that resemble war without actually being in a war. The NTC is a great environment in which to train as a soldier, but a platoon will only get out of the experience what it puts into it. The best advice is to understand that the NTC is a training environment and that everyone will make mistakes. The important thing is that the soldiers learn from those mistakes and use their experiences when deploying to a hostile nation.

Second Lieutenant Kreh is assigned to C Company, 4th Engineer Battalion, Fort Carson, Colorado. He was previously a platoon leader in A Company, 4th Engineer Battalion.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Engineer School

USAES Web Site. To access the U.S. Army Engineer School Web site, go to *http://www.wood.army.mil/eschool/.*

POC is LTC Billy Tollison, (573) 596-0131, ext. 3-7166; DSN -7166; or e-mail tollisob@wood.army.mil.

Lineage and Honors Updates. This office recently acquired the "current" Lineage and Honors statements of active, Reserve, and National Guard engineer units. In many instances, these statements are more than 20 years old. The Center of Military History (CMH), which maintains the Lineage and Honors of units, updates the statements only when it receives a formal request from a unit for an update. We recommend that you look at your Lineage and Honors and, if necessary, request an update from the CMH. The address is:

U.S. Army Center of Military History
ATTN: DAMH-FPO
103 Third Avenue
Fort McNair, D.C. 20319-5058

POC is Dr. Larry Roberts, Historian, -6109; DSN -6109; or e-mail *robertsl@wood.army.mil.*

Directorate of Training (DOT)

Engineer Bradley Fighting Vehicle (EBFV) Military Occupational Classification Structure (MOCS) Proposal. DA PERSCOM has approved this proposal, which authorizes engineers to use additional skill identifiers (ASIs) for the Engineer Bradley Operator Course, the Master Gunner Course, and the Bradley Leaders Course (BLC). The EBFV approval calls for the use of three existing skill identifiers/ASIs and the creation of one new ASI as follows:

- 3X for engineer officers who attend the BLC at Fort Benning, Georgia.
- D3 for engineer NCOs who attend the BLC at Fort Benning.
- J3 for battalion and brigade NCOs who attend the Bradley Fighting Vehicle (BFV) Master Gunner Course at Fort Benning.
- D5 for Skill Level 10 engineer soldiers is a new ASI. It will be awarded to one-station unit training (OSUT) graduates who also complete the Combat Engineer BFV Course at Fort Leonard Wood, Missouri. (The first course is tentatively scheduled for FY05.)

POC is Ms. Victoria Anthony, -6137, DSN -6137, or e-mail *anthonyv@wood.army.mil.*

Engineer Lessons Learned. To help build our lessons-learned database, we request that field units send us their significant engineer-related lessons learned. A recent addition to the database is task-force and higher after-action reports from Bosnia. In addition to lessons learned, we want to develop a digital archive of tactical unit SOPs to help units develop and maintain their SOPs. Please send copies of your SOPs to help get this started.

POC is Mr. Reggie Snodgrass, (573) 596-0131, ext. 3-7762; DSN -7762; or e-mail *snodgrar@wood.army.mil.*

Engineer Officer Advanced Course (EOAC) Training. In this course, we are emphasizing military operations in urban terrain (MOUT) as it applies to the Engineer Branch; stability and support operational scenarios; and engineer support to light forces. Current training materials are available at *http://www.wood.army.mil/OTD/EOAC%20Homepage.htm.*

POC is MAJ Steve Cross, Royal Australian Engineers, -4128; DSN -4128; or e-mail *crosss@wood.army.mil.*

Terrain Visualization II CD-ROM. We are in the final stages of completing the Terrain Visualization II CD- ROM and forwarding it to TRADOC for approval. We expect this TerraBase II product to be available by the end of second quarter FY01.

POC is CPT Chris Kramer or Mr. Ed Zielonka, (573) 596-0131, ext. 3-7060/7061, or DSN -7060/7061.

Countermine Training Support Center/Humanitarian Demining Training Center Web Site. Visit our revised Web site at *http://www.wood.army.mil/ctsc.*

POC is Dr. Steve Grzyb, -6199; DSN -6199; or e-mail *grzybst@wood.army.mil.*

Mobile Training Teams (MTTs). We have two mine-awareness MTT programs of instruction—one is for all arms and the other is engineer-specific. Contact us early in your preparation for deployment if you need an MTT so that we can put you on the calendar. We normally try to schedule the actual training within 3 months of deployment. Units are required to pay associated costs.

POC is Dr. Steve Grzyb, -6199; DSN -6199; or e-mail *grzybst@wood.army.mil.*

Unit Environmental Compliance Officer (UECO) Course. Development of our Web-based UECO course is progressing well, and we are now in the final reviewing stages. This course, which is designed to supplement current UECO courses as required by AR 200-1, *Environmental Protection and Enhancement*, will be provided to installations.

POC is MAJ John Whitfield, (573) 596-0131 ext. 3-5647; DSN-5647; or e-mail *whitfiej@wood.army.mil.*

Environmental Websites. The homepage for the Office of the Director of Environmental Programs at *www.hqda.army.mil/acsimweb/env* is an excellent site for "communication and information between major Army commands." The site also serves as an unclassified information source for all parties interested in the Army's compliance program. Another excellent site for critical information pertaining to environmental compliance is the U.S. Army Environmental Center (USAEC) homepage at http:*//www.aec.army.mil.* The USAEC provides technical services to HQDA, major commands, and commanders and also integrates, coordinates, and oversees implementation of the Army's environmental programs for the Army Staff, HQDA.

POC is MAJ John Whitfield, (573) 596-0131 ext. 3-5647; DSN-5647; or e-mail *whitfiej@wood.army.mil.*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals have recently been sent to ATSC to be printed and distributed. They are available for viewing and downloading from the MANSCEN Publications Page at *http://www.wood.army.mil/PUBS/newpubs/htm.*

- FM 3-34.331, *Topographic Surveying*. This manual, which combines FM 5-232 and TMs 5-232 and 5-237, is a guide for military occupational specialty 82D (topographic surveyor). It provides techniques not found in any commercial text concerning the precise determination of position, azimuth, or elevation of a point. Additionally, this publication describes and standardizes procedures for performing recons, preparing station descriptions, and reporting and briefing survey projects.
- FM 5-472, Change 1, *Materials Testing.* This change corrects some formulas given in the basic publication.
- FM 5-125, Change 1, *Rigging*. This change addresses safety considerations related to determining when wire rope is beyond the recommended serviceability.

The following publications will be sent for printing and distribution within the next 60 days:

- FM 20-32, Change 1, *Mine/Countermine Operations.*
- FM 5-250, Change 2, *Explosives and Demolitions.*

POC is Sandra Gibson, -4100.

2001 Engineer Unit Directory. The directory, which is updated periodically, is available at *http://www.wood.army.mil/PUBS/dsd/dsd.htm*. Units may submit changes/corrections at any time via e-mail to Jennifer Morgan at *morganj@wood.army.mil.*

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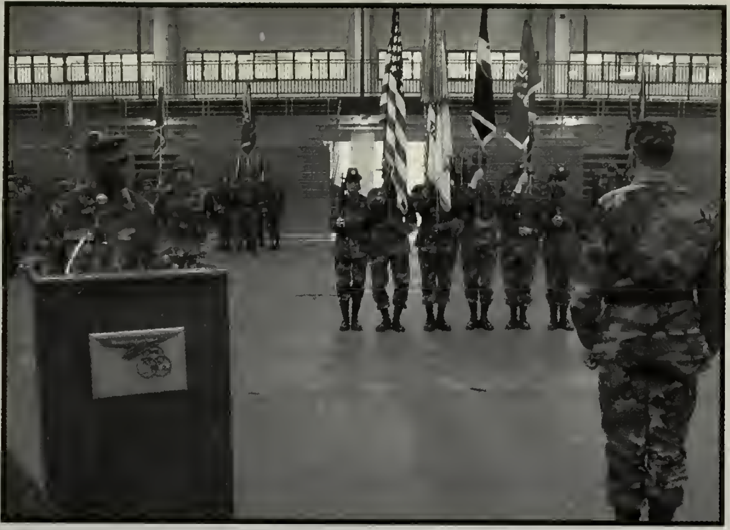
Engineer Assistant Commandant Promoted

By Specialist Peter Fitzgerald



BG Johnson addresses the crowd at his promotion ceremony.

(This article is reprinted with permission from *The Guidon.*)

The morning star seen on Friday, 5 January, belonged to Fort Leonard Wood's newest general officer, BG Ronald Johnson.

Johnson, assistant commandant of the U.S. Army Engineer School, was promoted to the rank of brigadier general in a Friday morning ceremony at Davidson Fitness Center.

"It is with great humility and healthy perspective that I accept this promotion today," said Johnson.

Service members, community leaders, Johnson family members, and friends all gathered to pay tribute to the Chicago native. The ceremony included a static parade formed by representatives from all the units on post. The 399th Army Band was also there to add an air of stateliness to the occasion.

MG Anders Aadland, post commanding general, opened the ceremony, describing Johnson as "a strong leader, outstanding role model for our troops, combat ready Sapper warrior, thoughtful mentor, father, and husband."

"He's had a huge role in the training of our Engineer soldiers and leaders," Aadland added.

Retired LTG Joe Ballard, 49th Chief of Engineers and former commander of the Army Corps of Engineers, was the ceremony's guest speaker. Ballard, a former Fort Leonard Wood commanding general, said the promotion was "a cause for celebration."

BG Johnson stands beside MG Aadland as he greets retired LTG Ballard.

"He is just the kind of general officer our Army needs," Ballard said. "He's an excellent leader. He takes care of his people, and he's conscientious and dedicated."

Ballard, along with Clyde Redmon, Johnson's father-in-law, helped pin on the general's new stars. Family members and colleagues cheered as Johnson strapped on the distinctive general officer's belt for the first time.

"It's a great feeling," said Rita Lambert, Johnson's sister-in-law. "We're very proud of Ron and his accomplishments. It's a lovely ceremony, and we're glad to be a part of it."

Taking the stand, Johnson thanked his family for their support. He also thanked his colleagues, mentors, and fellow soldiers by saying, "This really isn't about me. This is about those of you who have contributed to my success."

In closing, Johnson said, "This is a great day to be a soldier. It is a greater day to be a general officer."

Johnson was commissioned in the Corps of Engineers after receiving a bachelor of science degree from the U.S. Military Academy at West Point, New York, in 1976. Johnson assumed duties as assistant commandant of the Engineer School in August 1999. He has previously served as executive officer to the Secretary of the Army and senior aide de camp to the Secretary of the Army.

Johnson has also commanded the 130th Engineer Brigade in Hanau, Germany, and the 14th Engineer Battalion at Fort Ord, California, and Fort Lewis, Washington.

Johnson has a master's in operations research and systems analysis from the Georgia Institute of Technology in Atlanta. He has also been a mathematics professor at West Point and a 1995 U. S. Army War College Fellow at the Joint Center for Political and Economic Studies.

Johnson is married to the former Iris Redmon of Pensacola, Florida. The Johnsons have an 11-year-old son, Ian.

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Front Cover:

Engineers in Transformation! The M113 armored personnel carrier through the Bradley fighting vehcle to the light armored vehicle show changes in the way engineers move.

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

You can feel real excitement in the air as we head toward ENFORCE 2001! This issue is dedicated to the programs, initiatives, and dynamics that will receive top billing during this year's conference. It's all about change—the concept of "Engineers Leading Transformation" states our challenging case. With the assistance of our Regiment's outstanding leaders (active, reserve, and retired military; civilian; and contractor), bolstered by a rich slate of guest speakers, we are poised to peel this onion in every way we can. Be prepared to have fun, be steeped in camaraderie and branch revelry, and work to convey to your proponent the compelling requirements and priorities of our Regiment as it attacks the challenges of the Army's Transformation as a team. We hope to make profound steps toward our future during this year's conference and help resolve key issues regarding the Legacy, Interim, and Objective Forces.

Our ENFORCE 2001 theme clearly delineates our need to think strategically and plan proactively our branch azimuth and future needs as a vital member of the combined-arms team. As part of that process, the USAES leadership identified six breakout sessions to address key areas in which we need help from the field to analyze and develop recommended solutions. Each area is critical to the success of the Regiment and the Army as we pave the way toward Transformation. Here are just a few thoughts on each:

1. **Officer Development and Retention.** The Army has exciting things in store for our lieutenants. TRADOC just kicked off the pilot courses of the Basic Officer Leader's Course (BOLC) at Fort Benning for newly assessed 2LTs. The concept calls for all new 2LTs to attend BOLC—a field-oriented, leadership-challenging course—followed by basic-course attendance at their proponent school. The additional demands imposed by the Army's Transformation quest requires us to relook what we teach and how we teach our future leaders. We must prepare our young officers to be adaptive, imaginative, and fired up about being Engineers and Sappers. This breakout session will also review Engineer CPT attrition rates and initiatives to keep good officers in the Army.

2. **Combat Bridging.** We face many new challenges in attempting to meet the deployability and delivery requirements for assault gap crossing and bridging of the IAV and FCS-based forces. This breakout session will examine new methods, structures, and delivery systems to get the force across.

3. **Construction Engineering.** The IDIV Engineer organization will have organic horizontal and vertical construction assets that must fit into a C-130. What is the best ratio of vertical to horizontal capabilities for the Interim Force? Where should our priorities be for construction equipment—for today and tomorrow? This breakout session will seek to sort out the organization and materiel issues for our combat-heavy battalions of today and our construction requirements for the future force.

4. **IBCT/IDIV Engineers.** This breakout session will take a firsthand look at the Engineer units in the IBCT and IDIV and recommend changes to help us ensure optimal bang for the buck. This is an area we must get right the first time.

5. **Geospatial Engineering.** This is probably the area that is changing most rapidly. We are caught in the virtual opening of a new era, where the warfighter will not have those hard-copy 1:50,000 maps but can be inundated with terrain details that he would never dream possible. Does he want or need all that is available? Does the Engineer or S2/G2 provide the right stuff to the division/corps CG? How is NIMA helping the Army's Transformation of C4ISR?

6. **Mine/Countermine.** Will the Objective Force have mines in its arsenal? Now that we finally see conventional row minefields passing from the scene, what will be the mines and obstacles of choice for the future? How smart or brilliant will they become? On the countermine side, will we get beyond the heavy, brute-force breaching methods of the Legacy Force? What technologies show promise for the Interim Force breacher? How will the combined-arms maneuver force handle the mine threat? This breakout session will help us find answers to open the gates to mine warfare of the future.

ENFORCE 2001 week is full of important activities. For example, we look forward to the Engineer Regimental Review, where we will pay tribute to our great Regiment in a time-honored ceremony and see your unit's colors flying proudly. During the Army Engineer Association luncheon, we will welcome our new Honorary Colonel and CSM of the Regiment and say thanks to our outgoing pair. We will break ground for the Engineer Memorial Grove, which will be the future site of our Engineer AIT and OSUT Rites of Passage. This grove will help us remember our great heritage, those Engineers who served, and those who made the ultimate sacrifice for our country. As we execute the Army Transformation, we must never fail to look to our history as a guiding light.

So, we look forward to seeing you commanders, CSMs, DPWs, MACOM Engineers, DA civilians, and contractors of the Corps soon. Bring your running shoes and dress blues. Our Engineer Run will take us on a tour of the post that will prove to be challenging and worthwhile. The Regimental Ball will give us the opportunity to rest those achy feet as we honor the Itschner, Sturgis, and Grizzly Award winners and the Gold de Fleury Medal awardee for the year 2000. We cherish this outstanding opportunity for our leaders to come together as "One Corps, One Regiment, One Team." I appreciate the superb teamwork with USACE that makes a conference of this magnitude possible. We must proactively seek ways to overcome obstacles and be a part of the solution as the Army transforms over the coming decades. As I've said hundreds of times before, it is vital that we continue to speak with one voice throughout the Regiment. That does not mean we all agree; it means we meet and discuss divergent views, hash it out, and all emerge with a common understanding—that is our primary objective for ENFORCE 2001.

Happy 30th anniversary to this Engineer Bulletin! Thanks to our great staff for producing such a fine publication.

Essayons!

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

It's that time of the year again, as we prepare for our annual ENFORCE Conference. I have always looked forward to this conference and sincerely hope that all the senior leaders of the Regiment can participate. It will be a very informative week, and hopefully a relaxing one as well, reuniting the key leaders of our Regiment.

We have refined the agenda for the Council of CSMs Breakout Session, which is available on the Engineer home page. Generally, our plan is to receive addresses from LTG Flowers, Chief of Engineers; MG Aadland, Commandant of the Engineer School and MANSCEN Commanding General; and BG Johnson, Assistant Commandant of the Engineer School and DCG of Initial-Entry Training and comments from the outgoing and incoming USACE CSMs—CSM Lugo and CSM Dils. We have also invited representatives from the Sergeants Major Branch and the Engineer Branch to give us personnel updates. These branch overviews will shed light on the results of the recent CSM/SGM and MSG selection boards and how those promotions will affect our Regiment. We will round out our agenda with other keynote speakers who will give presentations key to engineer leaders.

I want to spend the rest of our week focusing on issues that will support the future of our Regiment as we move through the Army Transformation process—which is also the theme for ENFORCE.

As we prepare to meet in May, I need all of you to think about some issues that we need to address. I will do the same based on some of my visits and the many e-mails and phone calls I get.

As I stated in January's video-teleconference, I want to hold a breakout session with selected CSMs and key leaders on our expectations of the Sapper Leader course. I truly believe that this is the finest leader-development course available to the junior leaders of our Regiment. We have evolved this course since its inception, periodically altering the course to meet the needs of our Regiment. It's time to do that again, but with a focus on how engineers will fight and be employed in the future. We need to blend what's practical for our units now with what's relevant for the future, while gaining a bigger "bang for the buck." Garnishing a more successful graduation rate for our soldiers and an improved level of execution at the junior-leader level will be our topics of discussion.

In February, I went to Fort Polk, Louisiana, to participate in the first-ever Sergeants Major Trends Reversal Conference hosted by the Operations Group, Joint Readiness Training Center (JRTC). About 30 school and proponent CSMs/SGMs, together with observer-controllers from the various training centers, convened to discuss negative trends as observed at JRTC. The objective of this conference was to identify trends common to the many Battlefield Operating Systems and determine strategies to correct these negative trends.

From an engineer's perspective, we are seeing many of the same issues observed as training weaknesses that we have been addressing for the last 10 to 15 years. Precombat inspections/checks, load plans, standard marking systems, integration of engineers into the brigade combat team/task force, range cards, and others have been and continue to be deficiencies observed in the training centers.

I would ask all of you to be able to talk about your units' most significant training deficiencies. We will, as a part of our CSM/SGM Breakout Session, discuss these deficiencies and determine which, if any, have root causes. I will offer that much of the problem, as I see it, stems from the inability to perform home-station training to standard. We all have our thoughts on what factors attribute to this deficiency; bottom line is that I want to address the issues that we can fix at the sergeant through sergeant first class and lieutenant levels. Another question to ponder is, How can we as a Regiment get our sergeants and staff sergeants to understand the importance and value of hip-pocket training to support individual and battle-task skills?

Other discussion topics will be personnel distribution, use of Ranger-qualified NCOs, attrition/transition trends of senior NCOs, and the implied expectations of service.

As part of our CSM Council, we will front-load the week's events with an informal dinner in honor of CSM Edward Lugo. On 6 May, we will gather as a body of senior NCOs and pay tribute to a soldier who has served our Regiment superbly. It will be our opportunity to recognize him and spend an evening with him in a social setting. I encourage all who can to arrive early to attend this dinner. We will conduct a Regimental Review on 9 May to honor the Regiment.

I look forward to seeing all of you again.

Engineers Lead the Way!

Engineer Force-Modernization Strategy

By Captain William R. Guevremont III

The quest for excellence continues in TRADOC to keep all U.S. Army engineers well organized and equipped so they can continue to be the best Corps of Engineers in the world. General Eric K. Shinseki, Chief of Staff of the Army, has shown us how we are going to move toward the future. The Engineer Regiment will transform itself in parallel with the Army Transformation plan. To accomplish this, our leadership has produced a clear bottom line for the transformation strategy for our Corps of Engineers. We will—

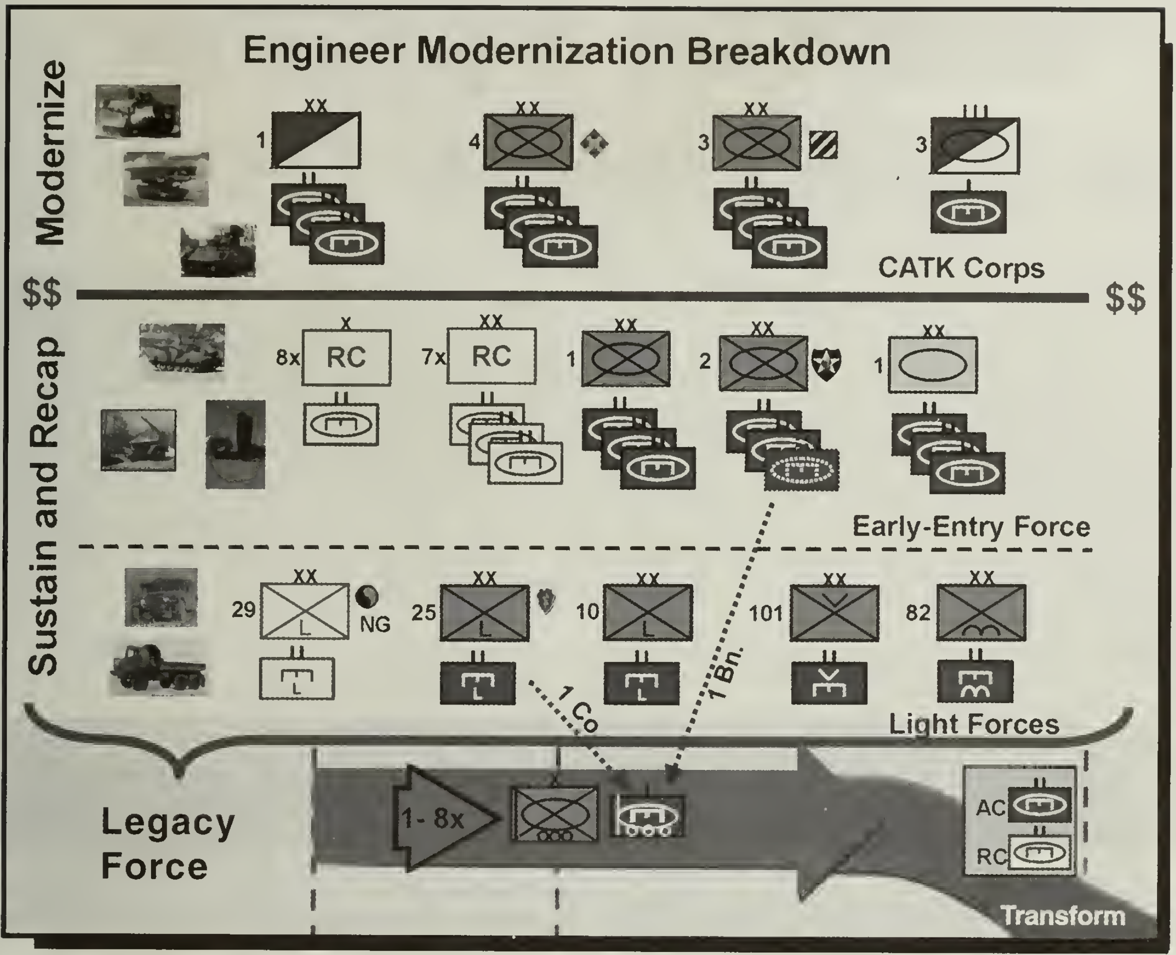
- Focus primarily on mobility, countermobility, and survivability systems.
- Continue integration of digital-terrain support through the current fielding schedule.
- Take risks in general engineering by only sustaining and recapitalizing the existing capabilities.

What does that really mean? In the figure on page 5, the first priority involves the engineers depicted on the top row. They will support the force called the Counterattack (CATK) Corps; continue with the Force XXI digitization; and be modernized with the Grizzly, Wolverine, and Bradley. The role of the CATK Corps is to follow the light and medium forces into theater to strike the decisive blow to threat forces, ending high-intensity conflict. The 1st Cavalry Division, the 3d Mechanized Division, the 4th Mechanized Division, and the 3d Armored Cavalry Regiment will see the best America has to offer in heavy "we-didn't-come-here-to-play" engineer equipment.

The forward-deployed engineers in Germany, Korea, and other OCONUS areas are part of the Early-Entry Force (second row of the figure). They will get deliberate sustainment programs to keep what they have in good shape. This means system depot-level rebuild programs and some replacement fielding of the same models these units have now. They are also the first to get the next-generation Future Combat System (FCS.) While they take good care of their M113 armored personnel carriers, they can look forward to radically changing warfare as we know it when they receive the FCS!

Not forgotten are our light engineers (third row of the figure). They are called the "Forced-Entry Force" with good reason. Seeing hundreds of helicopters and thousands of parachutes still stops the threat dead in its tracks. The current fielding of the deployable universal combat earthmover (DEUCE) and the high-mobility engineer excavator (HMEE) will keep the light engineers highly deployable and highly capable. They will also get some deliberate sustainment programs to keep current equipment going until transformation to the Objective Force.

Our engineers at Fort Lewis, Washington, bring into reality the deployable, lethal, and aggressive engineer company of the Initial Brigade Combat Team (IBCT) (see article, page 6). These engineers will define how future medium-equipped engineers will do business. Pursuit of the best equipment worthy of these pathfinders is the total focus of many here at Fort Leonard Wood, Missouri. Light rapid bridging, a new armored engineer squad vehicle, and the digitization of command-and-



control systems similar to Force XXI systems are what these engineers will use to support the IBCT.

Topographic engineers, the map makers of the past, are becoming the terrain-visualization experts of the future. Tailored hard-copy and digital maps will be there for the soldiers in the field who need them. They will be locally and specially made, giving information directly critical to the operation and situation (see article, page 10). But the cornerstone to producing information dominance for the Army is the large-screen digital displays that provide the maneuver force with instant comprehension of the terrain and its effects. The fielding of the series of Digital Topographic Support Systems (DTSS) is still on track, and we are dedicated to continue to keep topographic engineering a state-of-the art combat multiplier (see article, page 14).

Risk, as stated in the third bullet of our priorities, simply means that we will not upgrade the construction fleets in the near future. Our older fleets will be given the attention they need in the form of depot-level rebuild programs and limited replacement with like systems. We will take advantage of the modern civilian construction equipment that is available and buy it to replace our oldest models instead of developing our own. The lighter equipment will be aggressively sought to keep the light engineer force effective and deployable.

It is no accident that Reserve Component (RC) engineers are not on a separate row in the figure, but are a part of each row. These engineers will follow the Transformation pattern of modernization in sync with their force association. Engineers have always taken the Total Army concept to heart—76 percent of us who execute "Essayons!" are RC. These engineers are truly the strong arm of the Corps of Engineers, performing all those tasks that the Army depends on.

In every level of conflict, our engineer mission continues to be a primary enabler to Army operations. If you are not already deep into transition, take good care of the equipment that has served you well in the past, but also keep an eye on the future. The combat engineers of tomorrow will not fight as we do today—and the construction engineers will always be needed to perform the daily miracles of transforming chaos into civilization.

Captain Guevremont is a combat developments officer in the Directorate of Combat Developments, Maneuver Support Center, Fort Leonard Wood, Missouri. He was previously assigned to the 130th Engineer Brigade in Croatia and Germany and the 3d Armored Cavalry Regiment in Kuwait and Texas.

Concept and Organization of the IBCT Engineer Company

By Major Anthony O. Wright

The Army Transformation is highly visible at Fort Lewis, Washington, and no more so than with the engineers. From the first announcement on Transformation by Army Chief of Staff General Eric K. Shinseki, in October 1999, the engineers at Fort Lewis began work in earnest, receiving new personnel and equipment and turning in their legacy equipment. In September of last year, A Company, 168th Engineer Battalion, became the 18th Engineer Company—the first Interim Brigade Combat Team (IBCT) engineer company.

Structure

The structure of the engineer company in the IBCT is unique in the Engineer Regiment. It is a carefully tailored organization with a focused set of missions. It is important to understand the concept and mission of the IBCT and the engineer company's role within the brigade in order to understand its structure.

The brigade is designed as a full-spectrum early-entry combat force, optimized primarily for small-scale contingency operations in complex and urban environments.[1] The organizational and operational (O&O) concept emphasizes the need to balance the strategic responsiveness of the brigade against the requirements for battlespace dominance in determining the organizational structure. The organization must balance deployability, sustainability, and the in-theater footprint with lethality, mobility, and survivability. The IBCT's effectiveness is further enhanced by a design based on embedded unit capabilities—military-intelligence, signal, engineer, antitank, artillery, and combat-service-support (CSS) elements—that have been tailored specifically to the unique requirements of the unit's set of missions.

The brigade is an infantry-centric force with three motorized infantry battalions; a reconnaissance, surveillance, and target-acquisition squadron; an artillery battalion; a brigade support battalion (BSB); an antitank company; a signal company; a military-intelligence (MI) company; and the 18th Engineer Company (see Figure 1).

The organization and role of the engineer company is reflective of the embedded-unit-capability concept. When balancing the myriad missions an engineer unit may face against the deployability and sustainability of the brigade, the designers of the engineer company tailored the company to focus on providing mobility support to the brigade. Limited countermobility, survivability, and general-engineering capabilities are made possible using the same force structure required for the mobility mission. The engineer company supports the movement of combat forces to achieve a position of advantage with respect to enemy forces. Mobility operations maintain freedom of movement for personnel and equipment within the area of operations without delays due to terrain, barriers, obstacles, or mines. Combat mobility platoons are task-organized to maneuver elements to provide mobility support to mounted-maneuver, dismounted-assault, and urban operations.[2]

This focus on mobility support is evident in the company organization. The company is composed of three mobility platoons—each with three squads—and a mobility-support platoon with three sections. Figure 2, page 8, shows the objective organization and equipment.

The company has some limitations that are recognized in the O&O concept and its focus on mobility operations. The company has limited capability to support the brigade in major-theater wars or stability or support operations. In these environments, the IBCT requires additional engineer augmentation from the division or echelons above division.

Equipment

Each mobility squad will have an engineer squad vehicle (ESV), which is a variant of the infantry carrier vehicle. The ESV will be equipped with a remote weapon station M2 .50-caliber machine gun and mounted with obstacle-neutralization kits. The composition of the kits is not finalized, but it should include lightweight mine plows or rollers, a magnetic signature duplicator, and a minefield-marking system. Selection and delivery of the interim armored vehicle (IAV) is a future event. In the meantime, the company received nine light medium tactical vehicles (LMTVs), which are 2 1/2-ton cargo trucks equipped with advanced Single-Channel, Ground-to-Air Radio Systems (SINCGARSs) and situational-awareness systems to serve as surrogate squad vehicles until its ESVs are fielded.

Six of the nine ESVs tow mine-clearing line charges (MICLICs) and three tow Volcanos. To replicate the Volcano systems called for in the objective structure, the company mounted a four-panel Volcano system to a trailer. The Engineer School and Volcano product manager supported this endeavor by coordinating for safety testing and release at Aberdeen Proving Grounds, Maryland. The company is now able to replicate this capability while supporting the IBCT. The future system will be an M200 trailer-mounted Volcano that has recently been type-classified.

The company will eventually receive the Rapidly Emplaced Bridge System (REBS), which will provide responsive military load class (MLC) 30 gap-crossing capability for the brigade. Until the arrival of the REBS, the four common bridge transporters (CBT) in the engineer company are carrying medium-girder bridges, which provide 14.3 meters of MLC 30 bridging. This causes the only difference in personnel authorization between the current and objective structure, adding a military occupational specialty12C3O to provide technical expertise on bridging.

The mobility-support platoon also has six small emplacement excavators (SEEs) and six deployable universal combat earthmovers (DEUCEs). The fielding of the DEUCE to Fort Lewis in July 2000 went very well, but during support to Infantry Company Situational Training Exercises, several of the DEUCEs developed a track problem. The problem was unique to Fort Lewis and was caused by the glacial soil building up between the drive wheel and the track and causing track damage. The DEUCE product manager and Caterpillar® quickly developed track-tension warning sensors and material shields which proved effective at preventing damage. The Engineer School concurrently provided a master operator to Fort Lewis to develop tactics, techniques, and procedures (TTP) to reduce material build up. Personnel in the Brigade Coordination Cell are working with Infantry School personnel to determine the

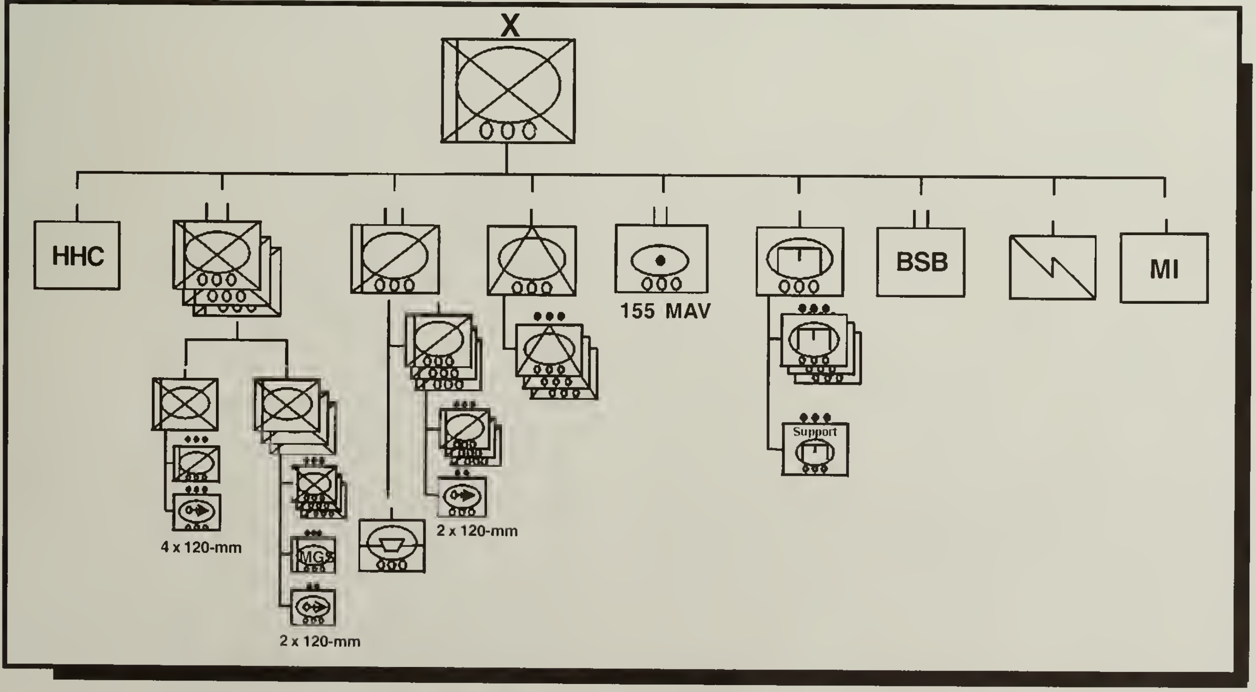


Figure 1. IBCT Structure

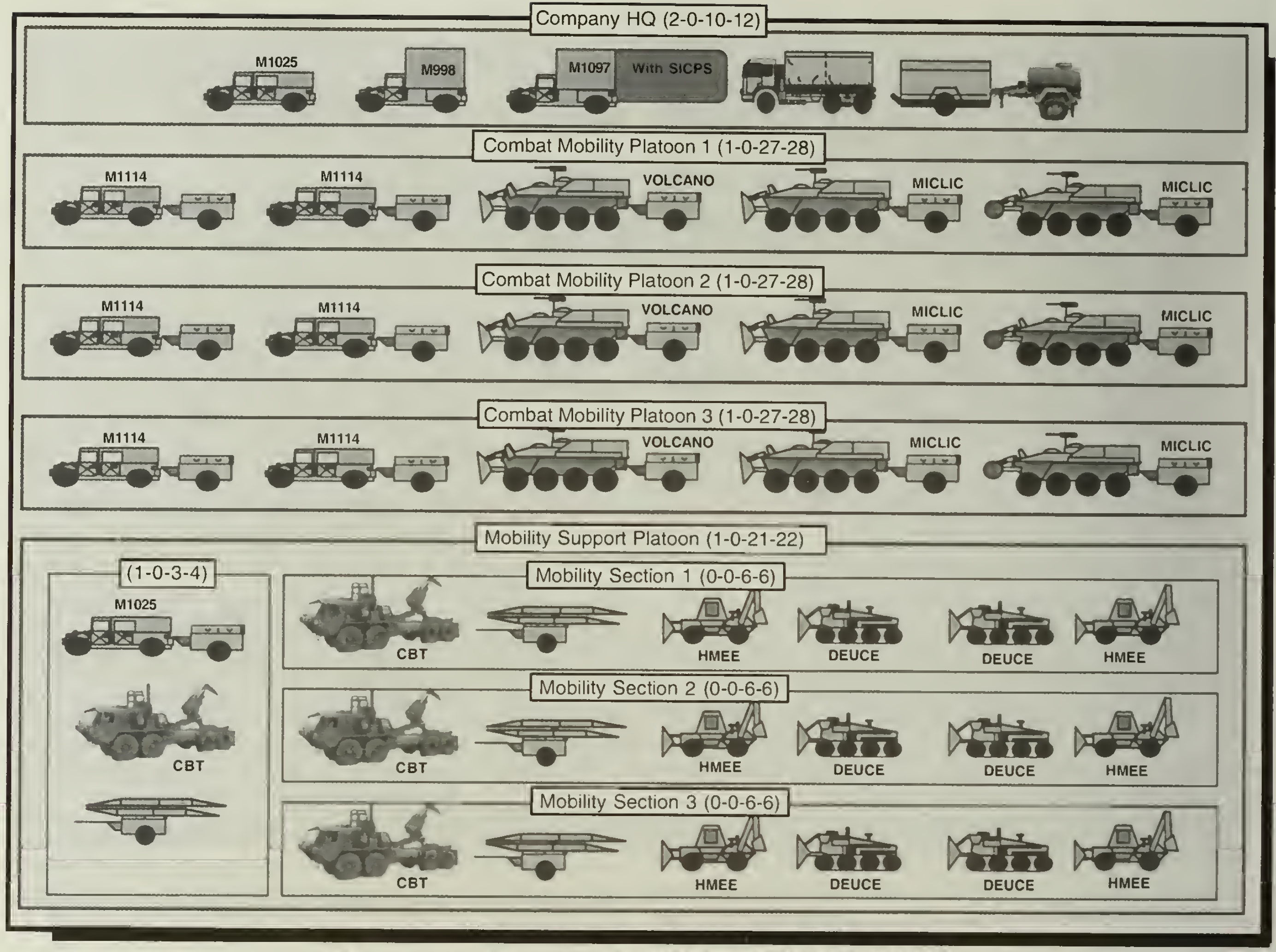

Company HQ (2-0-10-12)
M1025
M998
M1097
With SICPS
Combat Mobility Platoon 1 (1-0-27-28)
M1114
M1114
VOLCANO
MICLIC
MICLIC
Combat Mobility Platoon 2 (1-0-27-28)
M1114
M1114
VOLCANO
MICLIC
MICLIC
Combat Mobility Platoon 3 (1-0-27-28)
M1114
M1114
VOLCANO
MICLIC
MICLIC
Mobility Support Platoon (1-0-21-22)
(1-0-3-4)
M1025
CBT
Mobility Section 1 (0-0-6-6)
CBT
HMEE
DEUCE
DEUCE
HMEE
Mobility Section 2 (0-0-6-6)
CBT
HMEE
DEUCE
DEUCE
HMEE
Mobility Section 3 (0-0-6-6)
CBT
HMEE
DEUCE
DEUCE
HMEE

Figure 2. BCT Engineer Company Objective TOE (6-0-112-118)

doctrinally appropriate level of survivability support to the IBCT since the primary means of maintaining survivability in the brigade is through maintaining unit mobility and situational understanding.

Training

The company trains toward a centralized training task list (CTTL) that identifies the company-critical tasks. The platoons, squads, and sections have tasks that support the company CTTL. Currently, these tasks are to—

- Deploy/redeploy by air.
- Provide mobility support.
- Conduct battle-command operations.
- Provide limited survivability/countermobility support.
- Perform CSS operations.

Early in the Transformation process, the Engineer School provided teams of trainers to Fort Lewis to conduct a tactical-leaders course that focused on refreshing and reinforcing the skills that are critical to operation within the construct of the O&O concept.

The school also provided instructors for a course on military operations in urban terrain (MOUT) and demolitions, which gave concentrated instruction on TTP for supporting the force in complex and MOUT environments. The company received and trained on many new items from the major equipment described in previous paragraphs, to digital systems to gain and maintain situational understanding, to simple-but-useful items such as folding ladders that can be used to negotiate damaged stairways.

The maneuver companies and troops in the IBCT have conducted several iterations of situational training exercises. In each of these, the mobility platoons and mobility-support sections have demonstrated their worth as part of the brigade team, providing mobility, reconnaissance, and survivability support in varying environments.

Conclusion

The 18th Engineer Company and the 3d Brigade, 2d Infantry Division, are rapidly moving forward in Transformation. In March 2001, the 18th Engineer Company deployed to Fort Hunter-Liggett, California, for an extended field training exercise that stressed the company's ability to execute platoon-level combat-engineer missions. Transformation involves more than simply restructuring units and upgrading equipment. Transformation involves a mind-set change in how engineers fight as an essential force within

Soldiers conduct a MOUT demonstration during a training exercise.

an IBCT. The 18th Engineer Company is leading this effort for the engineer companies that are sure to follow. Engineers at Fort Lewis acknowledge that much has been learned over the past year—but there is still a long way to go. Hopefully, efforts in the 3d Brigade will prepare the second IBCT and its organic engineer company—A Company, 65th Engineer Brigade—for Transformation into another deployable, lethal IBCT.

Major Wright is the engineer operations officer in the Maneuver Division, Battlespace Training Directorate, Brigade Coordination Cell, Fort Lewis, Washington. Previous assignments include company trainer, Resident Training Detachment, 1457th Engineer Battalion, Utah Army National Guard; G3 war plans officer, aide-de-camp, and engineer plans officer, V Corps Headquarters; S3, 565th Engineer Battalion and 130th Engineer Brigade. MAJ Wright is a graduate of the Oregon Institute of Technology and the Engineer Officer Basic and Advanced Courses.

Endnotes:

[1] *Organizational and Operational Concept for the Interim Brigade Combat Team*, 30 June 2000, Chapter 1.

[2] Ibid, Chapter 9.1.

The Engineer Writer's Guide

We think engineers take a special pride in their profession, and *Engineer* is always looking for articles from readers who want to share their expertise, experience, and ideas. If you are a potential contributing writer, here are a few tips to steer you in the right direction:

Articles may discuss engineer training, operations, doctrine, equipment, history, or other areas of general interest to engineers.

We're especially interested in articles that have a "how-to-do-it-better" theme. For instance, we're not looking for articles telling readers how you conducted a routine field exercise. But if you think you have a "new-and-improved" way of conducting a tactical operation, training exercise, or other operational procedure that may prove helpful to other engineers, that's what we need.

Articles should generally come from contributors with firsthand experience of the subject being presented. Articles should be concise, straightforward, and in the active voice.

Length should range from 2,000 to 4,000 words. Generally, a double-spaced page should contain from 200 to 250 words. Provide either a 3 1/2-inch disk in Microsoft Word, along with a double-spaced copy of the manuscript, or send articles by e-mail to *bridgess@wood.army.mil.*

Articles containing attributable information or quotations not referenced in the text should carry appropriate endnotes.

Contributors are encouraged to include black-and-white or color photos, artwork, and/or line diagrams that illustrate information in the article. Include captions for any photographs submitted. Hard-copy photos are preferred, but we will accept digital images originally saved at a resolution no lower than 200 dpi. Please do not include them in the text. If you use PowerPoint, save each illustration as a separate file and avoid excessive use of color and shading. Please do not send photos embedded in PowerPoint.

Provide a short paragraph that summarizes the content of the article.

Include your full name, rank, current unit, and job title. Also include a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime telephone number.

Include a statement with your article stating that your local security office has determined that the information contained in the article is unclassified, nonsensitive, and releasable to the public. We do not require a hard copy of the clearance.

Reviews of books on engineer topics are also welcome.

Articles or book reviews may be mailed to: Editor, Engineer Professional Bulletin, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

All submissions are subject to editing.

If you have questions about an article you're working on—or considering writing—call Shirley Bridges, at DSN 676-5266, or commercial (573) 596-0131 ext. 35266. We look forward to hearing from you.

Note: Due to the limited space per issue, we do not print articles that have been accepted for publication by other Army professional bulletins.

Going, Going, Gone . . .

Bidding Farewell to the 1:50,000-Scale Topographic Line Map

By Colonel William Pierce

Knowledge of the battlespace is a prerequisite to any successful military operation. Maps provide that knowledge. At the National Training Center, Fort Irwin, California, the observer-controllers' recipe for success in battles and engagements is very simple: see the enemy, see yourself, and see the terrain. For more than 80 years, the Army has been using the 1:50,000-scale map, technically known as the Topographic Line Map (TLM), to see the terrain. The TLM has served us well in the past, but it has limitations that diminish its utility in this information age. The leaders at the National Imagery and Mapping Agency (NIMA) have found a better way. To achieve the Joint and Army Visions for information dominance, NIMA is undergoing a revolutionary change in how it provides terrain information to the Department of Defense. This article discusses the motivation for this change in direction, describes how the Army will benefit from the change, and outlines an implementation strategy.

NIMA's New Direction

Spurred by recommendations from the Defense and Army Science Boards in 1995, NIMA published a document called the Geospatial Information Infrastructure (GII) Master Plan in October 1997. Known as the Foundation Data (FD) Concept, this plan describes the changes that NIMA and the customers of mapping products must make to achieve the information-superiority tenets of the Joint Vision. The FD Concept is a revolutionary data-production scheme that is designed to provide warfighters exactly what they want when they need it. NIMA's old production strategy was based on a suite of standard products. NIMA made the Cadillac of maps—the 1:50,000 TLM. Unfortunately, there are several problems with this old friend.

First, the map was a predefined product. There may be features on the map a warfighter doesn't care about and new features that are important in planning. However, with the TLM, it did not matter what the warfighter wanted. He got the standard complete map or no map—nothing in between.

Second, NIMA produced these very expensive maps "just in case," based on commander-in-chief- or service-defined requirements. After production, the Defense Logistics Agency (DLA) updated the map catalogs, and the map sheets remained available for the warfighters in a DLA warehouse. After several years, the information on the map became dated. Updating TLMs is expensive and time- consuming. In fact, updating TLMs is unaffordable to the nation and unresponsive to the warfighters' needs.

Finally, the TLM isn't available worldwide. The current holdings of 1:50,000 and 1:100,000 TLMs cover less than 25 percent of the earth's surface. Over the past two decades, Department of Defense forces have begun operations without complete mapping coverage on several occasions (examples are Grenada, Desert Storm, and Somalia).

FD Concept Components

The first component is the foundation data. The foundation consists of a near-worldwide medium-resolution data set of imagery, features, elevation, and safety-of-navigation information (see Figure 1). Specifically, the foundation contains the following:

Imagery. This is both 1-meter stereo and 5-meter monoscopic imagery. These imagery data sets are relatively easy to make and can serve as a map background when grid lines are added. They provide the warfighter a view of the battlespace that is unavailable with a traditional map.

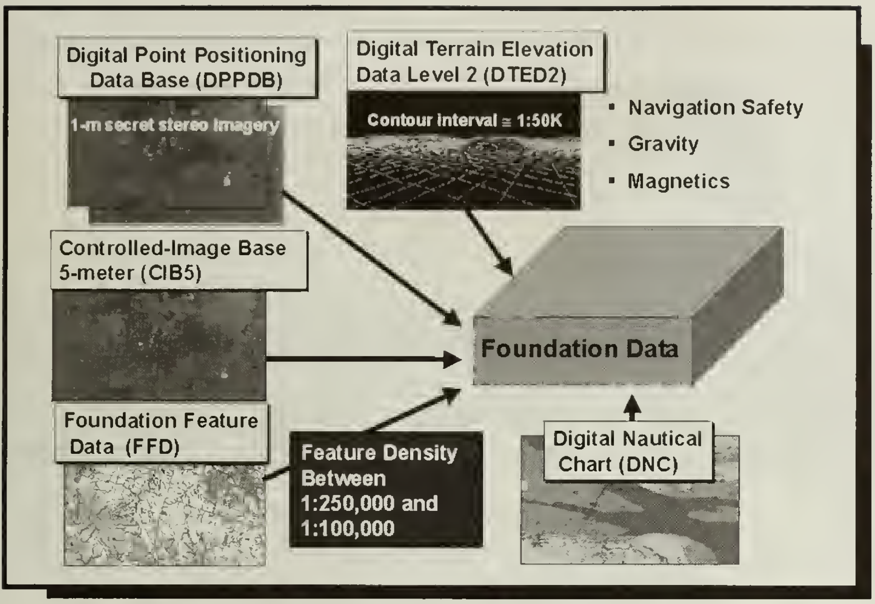

Digital Point Positioning Data Base (DPPDB)
1-m secret stereo imagery
Digital Terrain Elevation Data Level 2 (DTED2)
Contour interval ≅ 1:50K
▪ Navigation Safety
▪ Gravity
▪ Magnetics
Controlled-Image Base 5-meter (CIB5)
Foundation Data
Foundation Feature Data (FFD)
Feature Density Between 1:250,000 and 1:100,000
Digital Nautical Chart (DNC)

Figure 1. Foundation Components

Elevation Data. Based on the successful space-shuttle radar-mapping mission in February 2000, NIMA has the data it needs to cover all land between 80° south latitude and 84° north latitude with Digital Terrain Elevation Data Level 2 (DTED2)—meaning an elevation reading every 30 meters—by late 2003. DTED2 provides a contour interval approximately equal to that of a 1:50,000 TLM. Two main benefits of this elevation data are that—

- Warfighters can locate intervisibility lines in their area of operations using readily available line-of-sight algorithms.
- Warfighters can construct more accurate three-dimensional (3D) views and fly-throughs.

Foundation Feature Data (FFD). This component generates traditional map views. Collected at a resolution or density similar to a 1:250,000 Joint Operations Graphic (JOG) map, the data contains not only features —such as roads, vegetation, rivers, and lakes—but also attributes or descriptors of the feature—such as road widths, road/runway surface types, and tree types. These attributes are not restricted to the legend of the map but are an integral part of the database and can be called up by a few mouse clicks on the digital map.

Mission-Specific Data Set (MSDS)

Part of the revolutionary aspect of the GII Master Plan is the concept of an MSDS. Most warfighters would say that they could not conduct tactical operations using a 1:250,000-scale map. No one expects them to. While the components of the foundation provide enough information to conduct general planning and navigation, there is a clear recognition in the GII Master Plan that more information must be generated to satisfy the information needs of most commanders. This additional information is called mission-specific data (see Figure 2, page 12).

If a commander wants a higher-resolution data than the foundation components, he must ask for it. An MSDS is simply terrain data, *defined by the commander*, that answers the commander's terrain-information needs. As the terrain expert in the command post, the staff engineer must be able to translate the commander's needs into data requirements that NIMA can understand. Under this concept, NIMA can focus on collecting, processing, and disseminating data that is relevant to the commander's real interests (see Figure 3, page 13). Over time, as NIMA populates the database with foundation data and MSDSs, more and higher-resolution terrain information will be available to warfighters when they need it.

Another aspect of the plan is that all data sets are custom-made for warfighters. This makes the phrase "standard NIMA products" obsolete because there are no standard NIMA products. Even the FFD will vary in density depending on what is requested.

Benefits for the Army

The FD Concept will support the Army terrain-information needs in several ways:

- All foundation data and MSDSs will be tied to the same earth reference or datum. There are currently in excess of 100 datums in use worldwide. The datum used for each map sheet is listed in the legend of the map. One example of a common datum is North American Datum 1927 (NAD 27). The Department of Defense has defined the World Geodetic System 1984 (WGS 84) as the standard for military mapping. Thus, under the FD Concept, all data—whether digital or hard-copy—is tied to the same earth reference, providing a common view of the battlespace.
- Information learned about terrain for one operation is preserved for future use as it is incorporated into the NIMA database.
- The new data supports automated-decision support. The embedded attributes in the database will support automated analysis and generation of tactical-decision aids. Examples

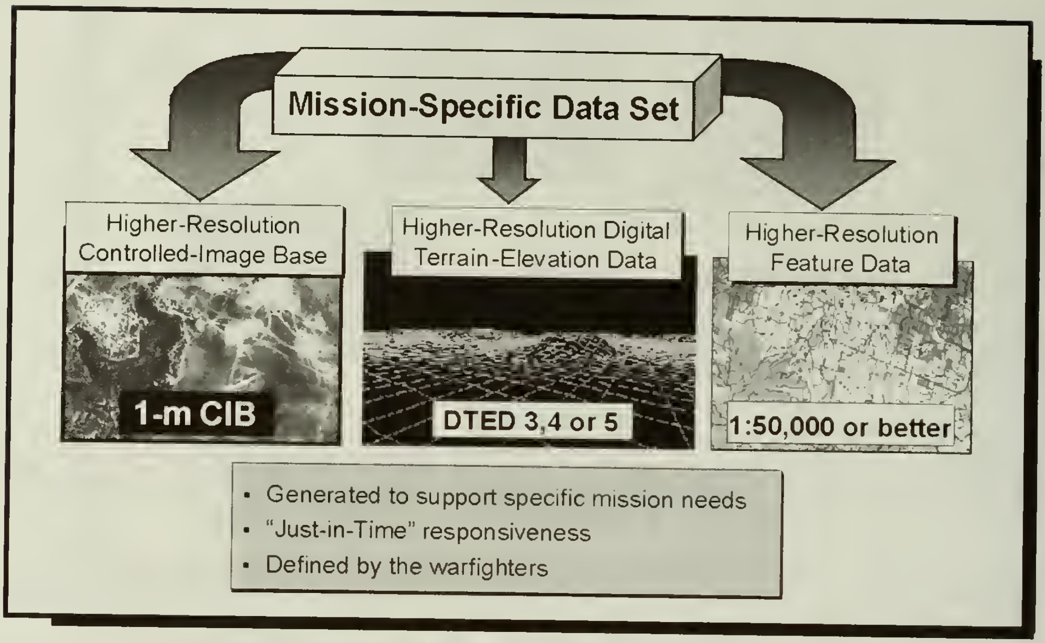

Mission-Specific Data Set
Higher-Resolution Controlled-Image Base
1-m CIB
Higher-Resolution Digital Terrain-Elevation Data
DTED 3,4 or 5
Higher-Resolution Feature Data
1:50,000 or better
• Generated to support specific mission needs
• "Just-in-Time" responsiveness
• Defined by the warfighters

Figure 2. Mission-Specific Data Set

include cross-country-mobility analysis, automated route selection, slope analysis, 3D fly-throughs, and line-of-sight analysis. This attributed data will provide the link between command, control, communications, computers, and intelligence (C4I) systems and modeling and simulation (M&S) systems to support realistic mission planning and rehearsal.

- Commanders can specify the content of the high-resolution terrain information they need to make decisions.
- Under current production processes, changing a map is a laborious task. Under the FD Concept, it will be possible to integrate field-derived information in local and national databases. The result is that every soldier is now a potential collector of terrain information. Attributes that can be determined on the ground— such as stream velocity, bank height, and bridge classification—can be captured and saved.
- For most warfighters, maps have been the primary source of terrain information. Under the FD Concept, image-based maps that can be produced relatively quickly will be available to the commander.

Implementing the FD Concept

To implement the FD Concept, the Army had to define Army-specific MSDSs. With superb support from NIMA, the Army developed packages of terrain information that resembled the 1:100K and 1:50,000 TLMs. These packages contained the features the Army has traditionally required on the TLMs. In addition, they also included attributes that support the automated analysis described in this article. In 1999, NIMA made a comprehensive set of hard-copy and digital prototypes of these MSDS-defined packages. The prototypes were sent to the field for evaluation and, based on feedback, the Army was able to specify its terrain-data requirements.

All services had questions about NIMA's implementation strategy. Since the FD Concept is more than just a database, there were concerns about requirements management, data dissemination, and exploitation systems. In other words, who can ask for MSDS, how will the data be delivered, and how will warfighters view the data? In this concept, commanders are able to ask for specific features or attributes in an area of operations using some type of Web-based architecture. As NIMA continues to generate MSDS during an operation to satisfy a commander's information needs, there is a recurring requirement to send this new, updated information to the field. Once the data is received, soldiers must be able to view the data on their Army Battle Command System (ABCS).

In August 2000, NIMA initiated a joint forum to address the implementation concerns of the services. This forum developed a Geospatial Concept of Operations, an updated version of the GII Master Plan, and cost estimates to fully implement the FD Concept. While all of the accomplishments of the forum are outside the scope of this article, some conclusions are worth noting.

- Due to resource constraints, NIMA cannot continue to provide legacy products to the services and agencies while simultaneously populating the database with foundation data and MSDSs. At some point, NIMA must make a break from the legacy production processes.
- Neither NIMA nor the services are ready to move to an environment where the content of the map changes with every request. While this is the vision of the GII Master Plan, the challenges associated with this information environment will not be solved in the next few years.

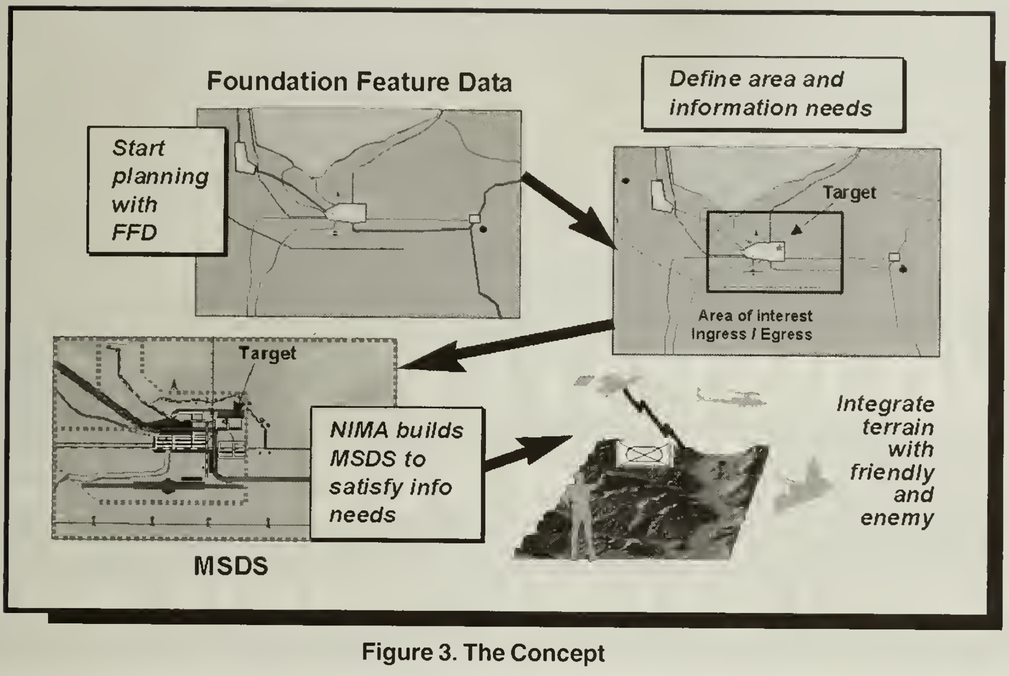

Foundation Feature Data
Start planning with FFD
Define area and information needs
Target
Area of interest
Ingress / Egress
Target
NIMA builds MSDS to satisfy info needs
Integrate terrain with friendly and enemy
MSDS

Figure 3. The Concept

- As a near-term transition step, the services-defined MSDS packages can serve as a bridge between the legacy products and the full implementation of the GII Master Plan.

Although this concept of treating MSDS packages like products seems to be a reasonable approach, it will be difficult for the services to move into the future for several reasons:

- NIMA is meeting most of its terrain-information needs with legacy products.
- Several aspects of the FD Concept require new training strategies. Modifying current topographic training is not sufficient. This new training will range from changes in technical topographic training and the military decision-making process, where ordering an MSDS is an explicit step, to basic map reading.
- NIMA's current holdings of this new data are relatively sparse.

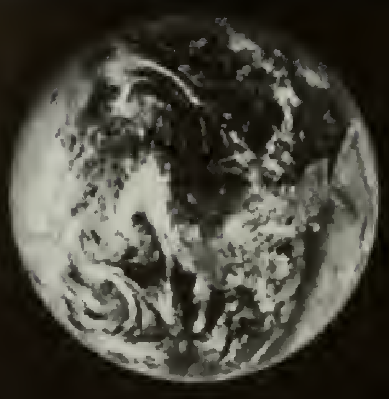
The motiviation to make this transition may come from NIMA. The NIMA leadership is currently looking at a strategy to end production of the legacy TLMs in the next few years. It could happen as early as FY03. This does not mean that NIMA will no longer provide the geospatial information that tactical commanders need to accomplish their missions. The geospatial production elements in NIMA are developing a strategy to either maintain the TLMs that have already been produced or replace them with MSDS packages. The existing stock of TLMs will still be available to the services for several years. However, any new TLM mapping requirements will be fulfilled by an Army-defined MSDS package that looks like a TLM to users.

NIMA produced several 1:100,000 TLM maps of the National Training Center for the 4th Infantry Division Capstone Exercise in April 2001. These maps were generated from FFD but are indistinguishable from the legacy TLMs. The only difference is that these products were made using NIMA's new production processes.

The Bottom Line

NIMA's implementation of the FD Concept will result in a much more comprehensive and relevant view of the battlespace for warfighters and will provide the level of detail required for information dominance. While some of the implementation details remain unanswered, it is clear that NIMA cannot continue to populate the new database while supporting warfighter requirements for legacy mapping products like the TLM. The soldiers NIMA serves will have the geospatial information they need to accomplish their missions in a format that is familiar to them under the FD Concept. It is now time for engineers to learn this important part of their mission and help their maneuver commanders through this revolutionary transition.

Colonel Pierce is the TRADOC Program Integration Officer for Terrain Data. In this capacity, he is the Army's centralized manager for the coordination and synchronization of all Army digital terrain-data requirements. He previously commanded the 299th Engineer Battalion at Fort Carson, Colorado, and was assigned to USSPACECOM J36 as the team chief for the ACOM, STRATCOM, and SOUTHCOM Joint Space Support Team. A graduate of the United States Military Academy, Colonel Pierce holds a master's and a Ph.D. in civil engineering from Rensselaer Polytechnic Institute and a master's in military arts and sciences from the Command and General Staff College. He is also a licensed professional engineer in Virginia.



GEOSPATIAL ENGINEERING:

A RAPIDLY EXPANDING ENGINEER MISSION

By Lieutenant Colonel (Retired) Earl Hooper, Mr. Brian Murphy, and Chief Warrant Officer 2 Chris Morken

> *"Those who do not know the conditions of mountains and forests, hazardous defiles, marshes, and swamps cannot conduct the march of an army."*
>
> *— Sun Tzu*

Exploitation of geospatial information is revolutionizing business, science, and government. Aerial and satellite remotely sensed imagery, Global Positioning Systems, and computerized Geographic Information Systems (GISs) are increasingly becoming the driving force for decision making across the local to global continuum. Planning urban growth, managing a forest, assessing insurance claims, positioning an automatic teller machine, routing 911 vehicles, and assessing groundwater contamination are just a small sample of the broad impact.

The GIS emerged as a viable technology in the early 1980s. In the 1990s, it exploded into one of the fastest growing and most widely adopted technologies in the information age. (See article "GIS—The Bridge Into the Twenty-First Century," *Engineer*, April 2000, page 34.) It spans a diverse group of user communities ranging from small villages to federal agencies and the military. This exciting technological development integrates remotely sensed and ground-based information into powerful decision-making analytical tools.

Geospatial Information in Military Operations

> *"The want of accurate maps has been a grave disadvantage to me. I have in vain endeavored to procure them, and I have been obliged to make shift with such sketches as I could trace out of my own observations and that of gentlemen around me."*
>
> *—General George Washington*

Military commanders have long realized the interdependence of the earth's land features and success on the battlefield. Those who stand out in history have visualized the terrain and its effects on the battle's outcome. A part of information dominance, the commander's knowledge of the terrain allows him to obtain a superior advantage in shaping the battlespace.

Accurate enemy, friendly, terrain, and weather pictures are the promises of digital command and control. Geospatial information provides the framework upon which all the other relevant strategic, operational, and tactical information is layered.

Digital geospatial information is the foundation for a superior view of the battlespace. Sophisticated computer workstations utilizing digital geospatial information perform a variety of military functions, such as navigation, mission planning, mission rehearsal, and targeting. Because of the increased breadth and utility of map information, the term "geospatial information and services" has replaced "mapping, charting, and geodesy" in joint doctrine.

The Geospatial Engineering Mission

Geospatial engineering is the development, dissemination, and analysis of terrain information that is accurately referenced to precise locations on the earth's surface. It provides mission-tailored data, tactical decision aids, and visualization products that describe the area of operation.

Geospatial engineering is an expansion of the traditional role of topographic engineering and is necessary to support Force XXI digitization and Army Transformation. It is a key component of the Engineer Force Modernization Strategy, bringing four principle operational capabilities to the Army.

Geospatial Data Generation. Terrain doesn't change as the enemy and friendly situations do. What does change is the resolution of our knowledge of the terrain. The implementation of the Foundation Data Concept (see article, page 10) brings terrain information as a requested commodity to meet the critical needs of the warfighter. Army geospatial engineering is part of an integrated data production with a future focus at Corps level.

Geospatial Data Management and Dissemination. Bringing the geospatial data needed to empower digital command and control is the most complex of the new engineer missions. The engineer role includes integrating data from higher echelons with information from field reports and tactical sensors to produce a common view of the terrain. Engineers must resolve the differences between various reports (conflation of the terrain data) to render a single common representation of ground truth. This "common topographic operating environment" must then move horizontally and vertically in the battlespace. While the future focus of management is centered at the division level, the resulting data must reach the lowest Battlefield Operating System—the land warrior or weapons platform.

Geospatial Data Exploitation and Analysis. Traditionally terrain analysis has been done at the division level and above by engineer terrain teams under the control of an assistant chief of staff, G2 (intelligence). This continues, but with the excitement of new command-critical data flowing into the process. Semiautonomous operations by maneuver brigades (distributed maneuver) demand a clear understanding of the impacts of terrain and weather. To meet this challenge, experimentation with dedicated terrain-analysis support to maneuver brigades began with Force XXI and expanded to all maneuver brigades during the Division Advanced Warfighting Experiment. Brigade support is now standard for working concepts and carries over to the Initial Brigade Combat Team (IBCT).

Geospatial Services (Surveying and Printing). Services often are not noticed unless they are absent. Such is the behind-the-scenes work of the military occupational speciality (MOS) 82D geodetic surveyer and MOS 81L photolithographer. High-resolution geodetic control provides the spatial accuracy needed for precision fires and navigation. The geodetic survey is the critical starting point whether opening a tactical airfield or delivering precise artillery. Printing services take on new meaning with the rapid increase in terrain knowledge. Printing continues as an echelon-above-division capability, but the future is in highly deployable digital-printing modules based at Corps level. The modules will be deployed to the critical point of need on the battlefield and will link with the terrain assets under engineer control. These digital printing systems incorporate the technology (the high-volume map printer) proven during the Joint Contingency Force Advanced Warfighting Experiment held at Fort Polk, Louisiana, in September 2000.

Implications for the Future

Geospatial engineering is not new. It is a new term denoting a much-expanded engineer mission. It impacts every soldier on the battlefield, with the engineer officer still charged to be the local resident expert. It is not the mission of only a few centrally located experts (assistant Corps engineers and terrain warrant officers) within the Regiment. Engineer officers at theater, corps, division, brigade, and battalion levels must be the terrain experts, responsible for helping the commander visualize the impact of terrain. To learn how to do that, visit the Terrain Visualization Center's Web site at *http://www.wood.army.mil/tvc*.

The rapid growth of the geospatial-engineering mission can be seen in the first digital division. With the addition of brigade terrain support and embedded data management, the 8-soldier division terrain-analysis team expands to a 34-soldier comprehensive geospatial-support structure. The IBCT expanded the role even further by demanding data management at the maneuver brigade to exploit the robust reconnaissance, surveillance, and target-acquisition capabilities rapidly. This demanded a more experienced terrain-analysis staff, capable data management, and the ability to integrate new geospatial information rapidly. The IBCT contains a 5-soldier geospatial support element led by an engineer warrant officer. All of this expanded geospatial-support capability is under management and control of engineers rather than the G2.

Summary

Geospatial engineering is a functional name change from topographic engineering, but it is not a new engineer concept. Engineers still have the task of providing battlefield visualization through analysis, synthesis, and database management. Geospatial engineering provides the services of geodetic surveying and reproduction. As the Army expands its capabilities through automation methods, the role of the geospatial engineer expands significantly. As commanders rely on an accurate depiction of the ground to conduct military operations successfully, so they rely on geospatial engineers. Geospatial engineering is indelibly linked to information dominance and the success of the digital force.

Before his recent retirement, Lieutenant Colonel Hooper was chief of the Terrain Visualization Center, TRADOC Program Integration Office for Terrain Data, Fort Leonard Wood, Missouri. He currently manages a law firm in the Fort Leonard Wood area.

Mr. Murphy is a supervisory physical scientist (GS-13)and the deputy chief of the Terrain Visualization Center. He is the principle developer of the geospatial-engineering concept. He also coauthored (with the Intelligence Center) the "Army Imagery and Geospatial Information and Services (AIGIS)" concept, which is undergoing worldwide staffing. Mr. Murphy is a retired military officer with 17 years of federal service (much of which is combat-developments experience).

CW2 Morken is a terrain-analyst technician in the TRADOC Program Integration Office for Terrain Data. He was previously assigned to the 3d Infantry Division in Germany; the Topographic Engineering Center, Fort Belvoir, Virginia; and the 29th Engineer Battalion, Fort Shafter, Hawaii. CW2 Morken holds a bachelor's in geography.

Disseminating Digital Terrain Data to Warfighters

By Ralph M. Erwin

Maneuver, engineer, artillery, intelligence, combat-support, and combat-service-support leaders need accurate, current, and relevant digital terrain data for mission planning, situational awareness, and viewing the "common operational picture"—or annotated planning map—of the battlespace. These digital maps will be the future basis for visualizing the common operational picture and for all mission analysis. The challenge is to get these commanders and their subordinates on that common picture, which is passed down the chain of command and embellished by planners at every level. Ultimately the picture is shared—or disseminated—at all levels and forms a common understanding of the operation. This article describes the concept for digital terrain-data dissemination currently being implemented in the Army's digital forces. Dissemination will be through the Army Battle Command System (ABCS), from the tactical-operations center down to weapon platforms and soldiers—or Land Warriors.

Who Is Working This Concept?

The TRADOC Program Integration Office for Terrain Data (TPIO-TD) is coordinating and synchronizing directly with the Program Executive Office for Command, Control, and Communications Systems and the project director for Combat Terrain Information Systems to design, test, and implement this concept. These three agencies are focused on integration, interoperability, and commonality aspects of terrain data and products for developing, testing, producing, and fielding Army systems that require digital terrain data.

What Is the Engineer's Role?

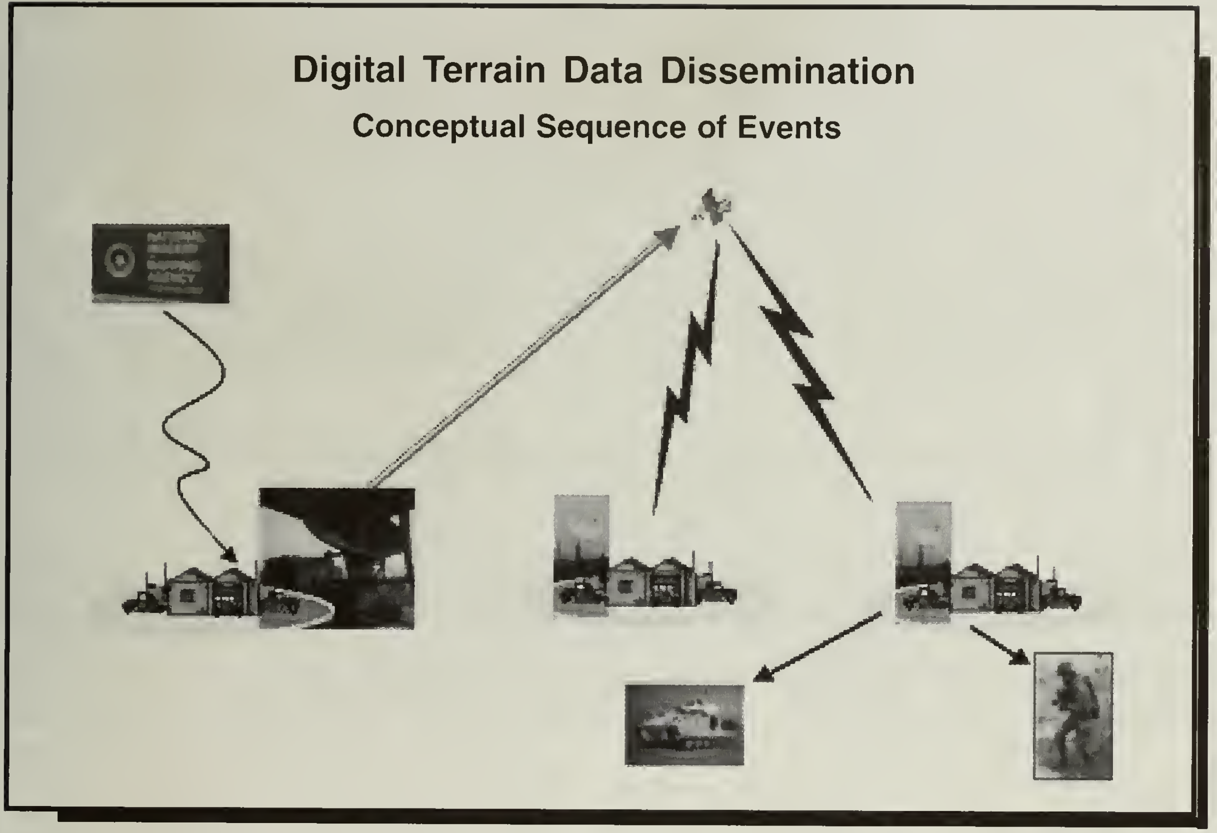
Throughout the implementation of the concept, establishing the common topographic operating environment (CTOE) will depend on digital terrain-data dissemination. The CTOE is an interoperable, fully integrated network of standard system architectures, standard data and communications protocols, software tools, and other infrastructures that facilitate a common topographic view of the battlefield. The senior engineer officer, in coordination with the terrain technicians, must ensure that the CTOE is established within a command so that all automated systems are operating "on the same sheet of music." This is accomplished by employing strong data- and database-management practices and solid tactical standard operating procedures (TACSOPs).

Who Needs Digital Terrain Data?

All warfighters have become consumers of the digital terrain data produced by the National Imagery and Mapping Agency (NIMA). Until recently, NIMA's primary Army customers were topographic-engineer companies and terrain detachments. Everyone understood that the right map was in a 155-millimeter canister that was managed and stored by the S2 or S4. Now, with the advent of the ABCS and other automated support systems, warfighters are "downloading" digital terrain data for near-real-time terrain evaluations, mission planning/rehearsals, and battlespace visualization. To establish and maintain the CTOE, the senior engineer officer should publish guidelines for subordinate units. This will ensure that units with Department of Defense activity address codes (DODAACs) and national stock numbers (NSNs) will adhere to the CTOE when they request digital terrain data and terrain products.

How Does Digital Terrain Data Get to End Users?

There are several levels and paths by which data flows to the battle-command systems and weapon platforms. The levels are the terrain technicians, the analysts, and the warfighters. The paths are basically a "push" or "pull" operation. Before we can discuss these operations, we must briefly explain the Foundation Data (FD) Concept (see article, page 10), which envisions that every unit will have the basic set (foundation data) of digital terrain data (a basic load, if you will) for a contingency area. This data consists of imagery, elevation, and feature information required for planning. The FD Concept further states that units will receive "just-in-time" digital terrain data that is relevant to their mission, unit type, and high-resolution digital terrain data. This Mission-Specific Data Set (MSDS) is the information that is collected, processed, and exploited by NIMA (and other collectors and analysis elements) and sent to the warfighters. The MSDS may reside in a database or may have been produced for another customer. There will be exceptions to this basic premise, but the sequence of foundation data preloaded and the rapid dissemination of the MSDS is the basis for the following discussion. Now, let's describe the push and pull of MSDS to the warfighters.



Digital Terrain Data Dissemination

Conceptual Sequence of Events

Terrain technicians and analysts are the Army's subject-matter experts in terrain analysis, topographic engineering, geospatial sciences, and cartography. They establish the push and pull methods to ensure that the right information is available to warfighters for mission planning and execution.

- Push: Topographic-engineer companies and terrain detachments will establish profiles with NIMA so that digital terrain data of concern to their area of interest is automatically pushed to them. This will include both foundation data sets and planned MSDSs.
- Pull: Often terrain technicians and analysts pull data based on a search of NIMA's Gateway (a military Internet-like link to terrain data) or order data using standard supply procedures. The management of all terrain data within a command (theater, corps, division, or brigade) is a critical task for terrain technicians and analysts.
- Push: Terrain technicians will "place" foundation data and the MSDS onto command-post map servers so that authorized command, control, communications, computers, and intelligence (C4I) systems can access a controlled set of digital terrain data.

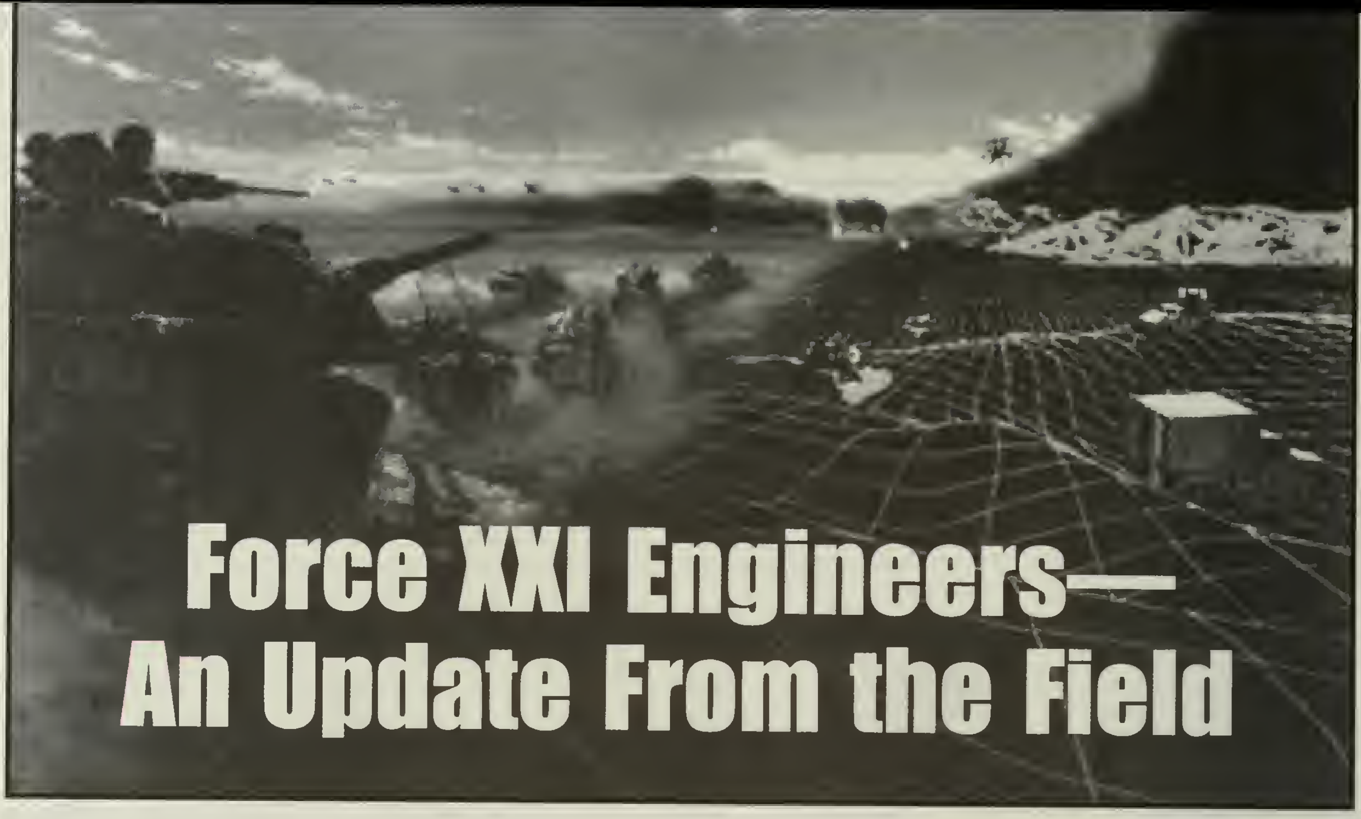
How Will the Digits Move?

The concept and implementation methodology currently accepted by the Army depends on a robust satellite-communications system to handle the dissemination of the MSDS from a division (or higher) command post to multiple receivers. The joint system being developed is the Global Broadcast Service (GBS), which will be used to disseminate data from a higher controlling authority to a "local map server." The GBS provides the bandwidth and data throughput to satisfy the broadcast dissemination of required MSDSs to warfighters. Some evaluations are being conducted during phase two of the 4th Infantry Division's Capstone Exercise in 2001. The exercise is considered the culminating exercise of the FDD.

Warfighters, the end users of digital terrain data, will—

- Pull data from the local map server that supports the command post. The majority of ABCSs will use the digital terrain data to visualize, analyze, and evaluate the terrain. Some mission-data load-preparation systems will also pull digital terrain data and make packages to export to weapons platforms with digital-map displays.
- Push data using a removable media, like an encryption keying device, which will be uploaded at designated command posts and/or downloaded at air, ground, and soldier platforms as often as it is required. Not only will digital terrain data be disseminated this way but also other items like signal operating instructions, system passwords, and operations overlays. Some recipients of this data will have portable systems installed in high-mobility, multipurpose wheeled vehicles (HMMWVs) and

(see Disseminating Terrain Data, page 48)



Force XXI Engineers—An Update From the Field

By Lieutenant Colonel Jeffrey A. Bedey

As the Army begins its Transformation, the decision was made to continue modernizing the Counterattack Force–III Corps while sustaining and recapitalizing both the Early-Entry and Containment Forces. For mechanized combat engineers, the modernization effort includes the decision to field both the Wolverine and M2A2 Operation Desert Storm (ODS) Bradley throughout the Counterattack Force.

"Force XXI Engineers–An Update From the Field" is a series of three articles. They are intended to be the catalyst for both discussion and the subsequent review of engineer-force structure as it relates to the fielding of both Bradleys and Wolverines as a part of the Force XXI engineer battalion. These recommendations are based on more than 6 years of experimenting, testing, fielding, and fighting the first Force XXI engineer battalion.

In "Transitioning to the Bradley," page 19, we recommend a force structure that we believe best complements the Force XXI concept. The structure is predicated on two 8-man squads per line platoon and 12 M9 armored combat earthmovers. Additionally we propose the method by which we would include, as a part of the modified table of organization and equipment, an engineer scout platoon.

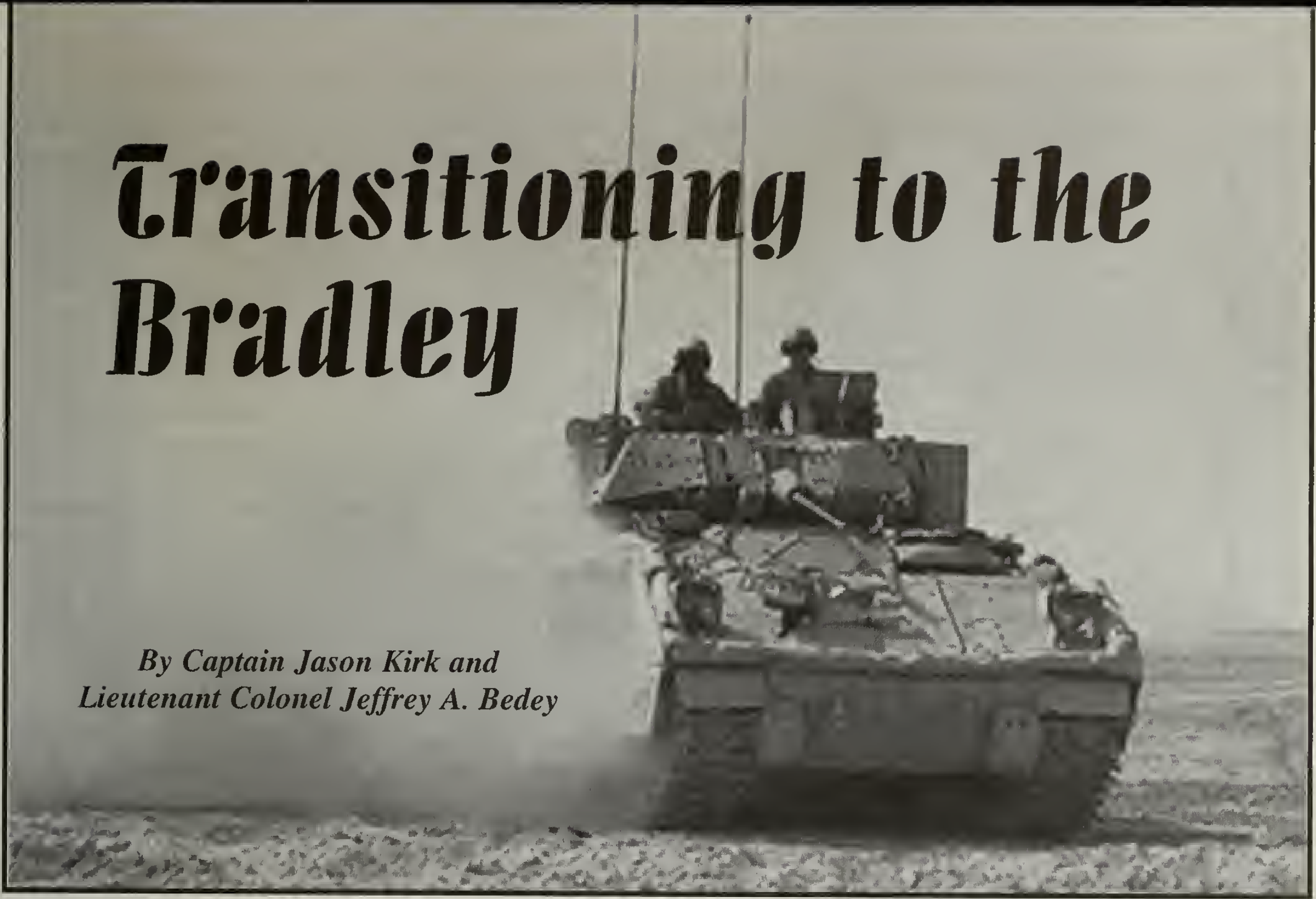
In "Facing the CSS Challenge," page 22, we propose transitioning the engineer support element to an engineer support company. This article describes, in detail, the shortfalls we experienced in fighting with the current organization and also takes into consideration the logistical impacts of fielding Bradleys in the Force XXI engineer battalion. We believe that setting the combat-service-support (CSS) structure is paramount to success on the battlefields of the twenty-first century. Our current structure is not adequate, and if we do not make the requisite adjustments now, fielding the Bradley into engineer battalions will preclude engineer support to the Army's Counterattack Force. We will be severely crippled as we attempt to provide the battlefield functions of mobility, countermobility, and survivability across the expanded Force XXI battlespace.

In "The Engineer Scout Platoon: A Necessity," page 29, we not only recommend the structure but also share with you our experiences while organizing, integrating, training, and fighting the engineer scout platoon at the National Training Center Rotation 00-10. Engineer scouts that are equipped with the Force XXI Battle Command Brigade and Below (FBCB2) System and task-organized in support of the brigade-reconnaissance-troop structure enable instant digital engineer situational awareness forward of the forward line of own troops (FLOT). These enablers and experiences validate that the engineer scout platoon is truly a necessity on the Force XXI battlefield.

Lieutenant Colonel Bedey commands the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division (Mechanized), Fort Hood, Texas. Previous assignments include platoon leader, company executive officer, and battalion maintenance officer in the 78th Engineer Battalion (Corps Wheeled); assistant S3 and company commander, 15th Engineer Battalion, 9th Infantry Division (Motorized); and battalion executive officer, 62d Engineer Battalion (Combat Heavy). LTC Bedey is a graduate of the Engineer Officer Advanced Course and Command and General Staff College and holds a bachelor's in construction engineering from Montana State University and a master's in construction management from Colorado State University.

Transitioning to the Bradley

By Captain Jason Kirk and Lieutenant Colonel Jeffrey A. Bedey



As our Army begins the journey of Transformation, the other major developmental initiative—Force XXI—has matured into a combat-ready organization. Early in FY02, the Army's first Force XXI division, the 4th Infantry Division (Mechanized), Fort Hood, Texas, will assign its 1st Brigade Combat Team—with its organic 299th Engineer Battalion—the division ready-brigade mission. This mission is one in a long line of critical missions that the 1st Brigade and the "Proven Pioneers" of the 299th have completed for the Army over the past decade. From March 1994 to December 2000, the Force XXI 1st Brigade and the 299th have experimented, tested, and now fielded Force XXI digital systems. The 299th reorganized under two significant modified table of organization and equipment (MTOE) changes as the conservative heavy-division design evolved. The 299th—along with A Company, 588th Engineer Battalion—also deployed the Army's first Bradley fighting vehicle-equipped engineer company to the National Training Center. The significant lessons learned during all of these missions are vital to the Engineer Regiment as additional combat-engineer battalions become digital and as the Force XXI engineer table of organization and equipment (TOE) evolves again with the fielding of the M2A2 Operation Desert Storm-Engineer (ODS-E) Bradley.

Fundamental to the Force XXI concept is a smaller force that achieves increased lethality through enabling systems. The force-structure decrease has taken the mechanized division from an 18,000-soldier organization to one with just over 15,000 soldiers. The divisional combat-engineer battalion has downsized from 442 soldiers to 288 as of the FY01 TOE. (This number is 312 in the FY02 TOE, which includes manning for the yet-to-be-fielded Grizzly breacher (see article, page 36). Critical enablers fielded within the 299th Engineer Battalion include the digital command-and-control systems—the Maneuver Control System (MCS) and the Force XXI Battle Command Brigade and Below (FBCB2) System. The other vital enabler in the 299th is the engineer scout platoon. These digital systems and the well-resourced and trained engineer scout platoon have enabled the Force XXI combat engineers to truly do **more** with **less**—and do it **better**—as they support the maneuver brigade fight across an expanded battlespace.

The increased situational awareness that the commander achieves through the MCS at the battalion tactical-operations center and the FBCB2 System mounted on all combat vehicles enables increased reliance and more efficient use of dynamic obstacles throughout the battlespace in both offensive and defensive operations. This increased situational awareness—shared throughout the digitized force—also greatly decreases the likelihood of casualties from mine strikes. (Information on observed enemy obstacles, as well as planned or emplaced friendly obstacles, is shared instantaneously.)

There are two critical areas where the Force XXI engineer battalion has made reductions—manpower and equipment. Additionally, the Force XXI engineer battalion no longer has an organic support platoon that provides maintenance, food-service, and distribution functions. Rather, the supporting forward-support battalion—in the form of an engineer support element—provides these logistical functions. As the 299th adopted this leaner organization, it developed methods to **improve** combat-engineer operations:

The Force XXI combat-engineer platoon has two sapper squads, not three.

- In *offensive operations*, combat-engineer platoons continued to provide effective mobility support by increased reliance on mechanical, as well as explosive, breaching with each squad towing a mine-clearing line charge (MICLIC). Command and control of breaching operations is **better** in that the sapper platoon sergeant is now forward—mounted in the platoon's fourth M113 armored personnel carrier. The 299th developed the tactics, techniques, and procedures (TTP) of always organizing sapper platoons in breaching stacks, with each stack consisting of a proofing blade (M1 tank plow), a sapper squad with a MICLIC, the platoon leader or platoon sergeant for command and control, a Wolverine/armored vehicle-launched bridge (AVLB), and an M9 armored combat earthmover (ACE). Force XXI engineers are able to provide **better** mobility support by immediately broadcasting a "breach-lane-report overlay" or a "scatterable-mine bypass-report overlay" to all FBCB2 System-equipped units in the maneuver brigade. The engineer scout platoon further reduces our reliance on conventional breaching methods by providing detailed mobility intelligence.
- In *defensive operations*, increased situational awareness and focused training enabled the 299th to deliver **better** synchronized countermobility effort with no decrease in linear frontage covered (cited by National Training Center engineer trainers) despite having fewer sappers on the ground. Increased planning synchronization achieved through the Digital Terrain Support System, the MCS, and the FBCB2 System facilitated more effective employment of the full menu of scatterable mines—ground- and air-delivered Volcanos, artillery-delivered aerial denial artillery amunitions/remote antiarmor mines (ADAMs/RAAMs), air-delivered Gators, and ground-emplaced Hornets and Modular Pack Mine Systems (MOPMSs). Countermobility training focused on scatterable-mine employment, putting the obstacles at the right place at the right time. The engineer scout platoon trained to effectively employ the Hornet and MOPMS munitions, the line companies focused training on ground-delivered Volcano and MOPMS employment, and the battalion's engineer-support-area personnel (led by the battalion S4) trained to serve as a launching and reload point for air-delivered Volcano platforms. The Force XXI digital systems, coupled with this focused training effort, enabled the 299th to achieve the Force XXI imperative to shape the battlespace.

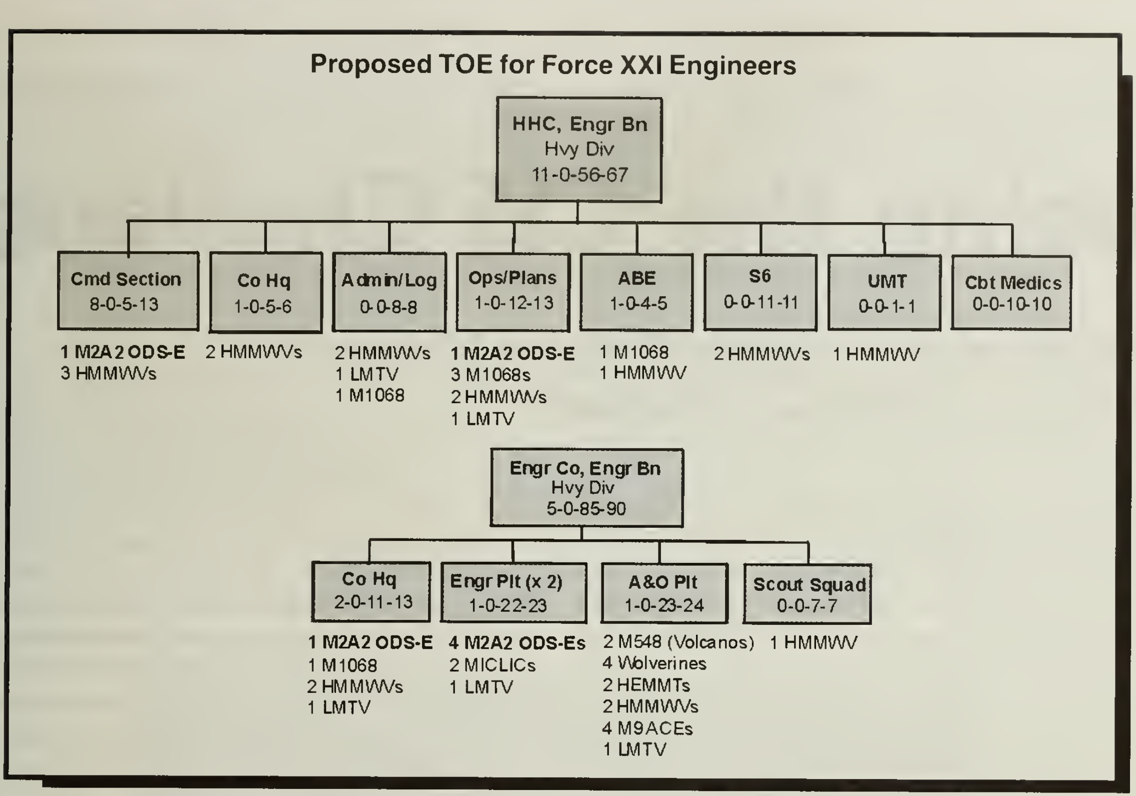
The Force XXI assault-and-obstacle (A&O) platoon has four M9 ACEs, not seven (a total of 12 in the battalion, not 21).

- In *offensive operations*, each of the four M9s is attached to a sapper squad. While the company as a whole has lost redundancy in blades, this organization is **better** in that it has a decreased sustainment requirement—another imperative of Force XXI operations.
- In *defensive operations*, there is less of a requirement for vehicle-survivability positions since the Force XXI brigade fights more dispersed and maintains the flexibility to truly defend in sector and reposition throughout the fight. The 299th's TTP to effectively deliver survivability support where required were to form blade teams by pairing each of the attached echelon-above-division combat-support-equipment platoon's D7 dozers with an M9 ACE. The M9s that were not committed to digging turret-defilade fighting positions were used to dig tank berms or deception positions. To maximize frontage in the countermobility dig effort, the 299th adopted the TTP of digging levels 1 and 2 tank berms before dedicating effort to full-depth tank ditches. Command and control and battle tracking of the defensive preparation is **better** with the ability to quickly send obstacle-status reports and overlays and clearly understood fighting-position grid coordinates digitally rather than through FM voice communications.

As the Army begins its Transformation, the Chief of Staff decided to continue modernizing the Counterattack Force–III Corps while sustaining and recapitalizing both the Early-Entry and Containment Forces. For mechanized combat engineers, the modernization effort includes the decision to field both the Wolverine and M2A2 ODS-E throughout the Counterattack Force. The Bradley fielding plan calls for a one-for-one replacement of the current 28 M113 armored personnel carriers in mechanized combat-engineer battalions beginning with the 91st Engineer Battalion, 1st Cavalry Division, in FY02. (In addition, the fielding plan includes an M2A2 ODS-E for the engineer battalion S3, a requirement validated during the breach-focused National Training Center Rotation 00-10 in August 2000, for a total of 29 Bradleys.)

The M2A2 ODS-E will provide increased mobility, lethality, survivability, and sustainability as Force XXI engineers conduct combat operations alongside their infantry and armor counterparts. Since Force XXI engineers are employed as another maneuver element in the brigade combat team—per the emerging doctrine in FM 5-71-3, *Brigade Engineer Combat Operations (Armored)*—the M2A2 ODS-E is the right platform from which combat engineers can fight and win on the twenty-first-century battlefield. Incorporating the lessons learned in successfully employing the 288-soldier combat-engineer battalion, the 299th proposal for the Bradley TOE is a 333-soldier organization. Critical to the success of this organization in support of the Force XXI maneuver brigade is the establishment of an engineer support company—resourced and manned to provide combat service support (CSS)—and the engineer scout platoon.

The Force XXI engineer battalion no longer has an organic support platoon that provides maintenance, food-service, and distribution functions. An engineer support element that is organic to the base support company of the maneuver brigade's forward-support battalion now provides those functions. The 299th's lessons learned and recommendations regarding CSS are outlined in detail in the article "Facing the CSS Challenge"



on page 22. This article describes, in detail, the shortfalls we experienced in fighting with the current organization and also takes into consideration the logistical impacts of fielding Bradleys in the Force XXI engineer battalion.

The Force XXI organization dedicates a brigade reconnaissance troop (BRT) within each maneuver brigade to provide the commander with responsive intelligence and security across a battlespace with an expanded width and depth. To fully support the engineer-specific reconnaissance requirements across this battlespace—and to take advantage of the capabilities of the Hornet, MOPMS, ADAM/RAAM, and air-delivered Volcano scatterable-mine systems—the 299th organized with dedicated engineer scouts. By organizing, equipping, and training these engineer scouts (whether organized as a platoon under control of a battalion or a brigade), they became an integrated element of the BRT, and the 299th provided **better** and more effective engineer reconnaissance and dynamic point-obstacle emplacement. The engineer scouts are truly both a countermobility and a mobility enabler on the Force XXI battlefield. Because the FY01 TOE has authorized 24 soldiers for the not-yet-fielded Grizzly breacher, there was an opportunity to incorporate a 22-soldier engineer scout platoon into our organization. The figure above shows our recommended engineer Bradley TOE, which includes the engineer scouts organized under each line company either to fight as a squad under a task force or as a platoon with the BRT. The 299th's lessons learned and further recommendations concerning the engineer scouts are further outlined in the article "Engineer Scout Platoon: A Necessity"on page 29.

This proposed Force XXI engineer TOE allows the battalion to take full advantage of the enabling capabilities that Force XXI digital systems provide. The dedicated engineer scout platoon provides increased versatility to the maneuver commander in employing dynamic obstacles and in providing focused engineer reconnaissance that facilitates freedom of maneuver on the expanded Force XXI battlefield. Mounted in the more survivable, mobile, and lethal Bradley fighting vehicle, Force XXI combat engineers will be more capable to facilitate the dominant maneuver of the brigade combat team. With lessons learned and then refined in warfighting experiments and testing that began in the late twentieth century, this proposed TOE is the right evolution for Force XXI engineers in the twenty-first century.

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Lieutenant Colonel Bedey commands the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division (Mechanized), Fort Hood, Texas. Previous assignments include platoon leader, company executive officer, and battalion maintenance officer in the 78th Engineer Battalion (Corps Wheeled); assistant S3 and company commander, 15th Engineer Battalion, 9th Infantry Division (Motorized); and battalion executive officer, 62d Engineer Battalion (Combat Heavy). LTC Bedey is a graduate of the Engineer Officer Advanced Course and Command and General Staff College and holds a bachelor's in construction engineering from Montana State University and a master's in construction management from Colorado State University.

Facing the CSS Challenge

Transitioning the Engineer Support Element to an Engineer Support Company

By Captain William L. Judson, Major Richard J. Muraski Jr., and Lieutenant Colonel Jeffrey A. Bedey

For many, the term Force XXI has only one meaning—digitization. But for those who serve in the Army's first Force XXI division—the 4th Infantry Division (Mechanized) at Fort Hood, Texas—Force XXI has many implications. This article focuses on only one of the challenges of being a Force XXI organization—combat-service support (CSS). Under the old Army of Excellence modified table of organization and equipment (MTOE), CSS was organic to the mechanized engineer battalion in the form of a battalion support platoon found in the headquarters company. The support platoon consisted of a food-service section, a distribution section, and a maintenance section. Force XXI changed all of that. No longer is CSS organic to the engineer battalion; instead, support has been reorganized under the command and control of the forward-support battalion (FSB). Today, the engineer support element (ESE) provides CSS to the engineer battalion.

The engineer battalion was not the only organization in the division to undergo such a change. CSS to maneuver battalions was also reorganized under the command and control of the FSB. However, there were some fundamental differences between the CSS to maneuver battalions as compared to the engineer battalion. The reorganization established forward-support companies (FSCs) for each supported maneuver battalion, while the ESE—initially an engineer support platoon (ESP)—was established to support the engineer battalion. The ESE—which is not a company—is, in fact, subordinate to the base support company. This subtle difference has a significant impact on how CSS is provided to the engineer battalion.

The Army leadership knowingly took significant risks with engineer CSS structure several years ago. Experiences at National Training Center (NTC) Rotation 99-05, Fort Irwin, California, proved that this risk was so great that it placed the overall maneuver mission at risk, and the initial ESP was upgraded to an ESE.

ESE Organization

The multifunctional ESE operates on a centralized CSS concept, providing all classes of supply, food service, distribution, and tactical field maintenance to the engineer battalion and to itself. The ESE leader is capable of cross leveling between the engineer repair sections/teams to weight the main effort as the mission dictates. The three forward engineer repair sections (FERSs) and three engineer combat repair teams (CRTs) provide the immediate capability and task-organization flexibility to support our Force XXI engineer battalions (see Figure 1, which is from FM 5-71-3, *Brigade Engineer Combat Operations [Armored]*).

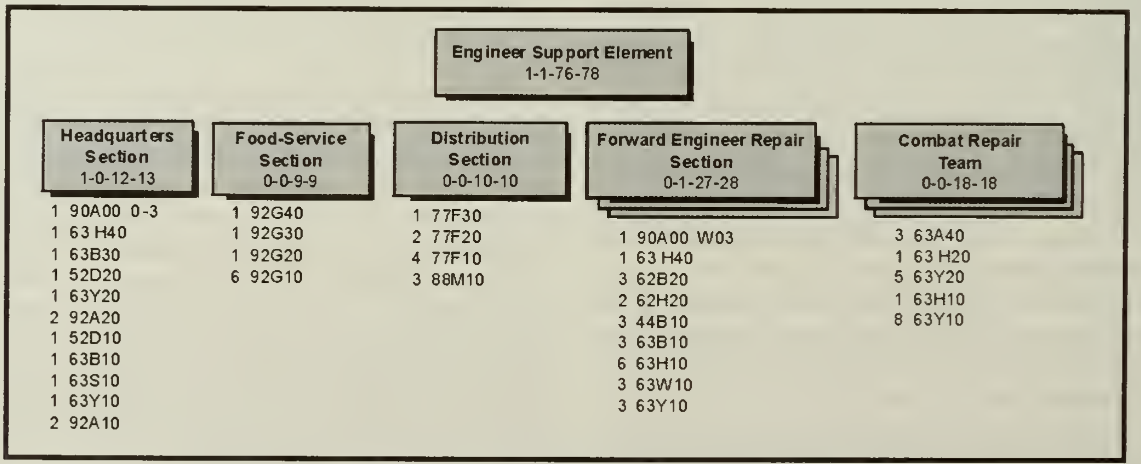

Figure 1. Engineer Support Element Personnel TOE 63108F00

Headquarters Section — Provides command and control and overall supervision of the element and its assigned or attached personnel. Through the direction of higher headquarters and the allocation of a logistics officer (O3/90A00) as the leader and an E7 as the senior equipment-maintenance NCO and operations sergeant, the headquarters section is designed to provide a flexible command-and-control environment.

Food-Service Section — Plans and conducts food-service support to the engineer battalion along with Class I support, using its assigned mobile-kitchen trailer. The food-service section can be modularized to support companies task-organized in an attached command relationship.

Distribution Section — Provides petroleum, oil, and lubricants (POL) and supply-point distribution to the engineer battalion. This section, like the others, is capable of being modularized. Of note is the extremely limited distribution capability outside of bulk POL (see Figure 2).

FERSs/Engineer CRTs — Provide maintenance support for engineer equipment. Each of the repair sections provides command and control for the repair teams. The engineer repair technician (W3/919AO) and the senior maintenance-section NCO provide maintenance and task-organization expertise. Each engineer CRT is organized with mechanics; recovery assets; contact trucks; cargo trucks; and forward repair systems, heavy (FRSH) and is supported with surge capability (the ability to push more maintenance support forward) in the FERS. Regardless of the task organization, each company CRT is always collocated with the engineer company to provide immediate forward repairs, and the team "works for" the engineer company first sergeant, even though its higher headquarters is the ESE. Additionally, mechanics in the Force XXI division are now multifunctional—or capable of providing unit-level and direct-support maintenance—with the theory being that they are now able to complete levels –20 and –30 maintenance without delay to the customer.

CSS Personnel (Current)

Forward Support Company Armor Pure		Forward Support Company Infantry Pure		Engineer Support Element	
Strength		**Strength**		**Strength**	
Officers	5	Officers	5	Officers	1
Warrants	1	Warrants	1	Warrants	1
Enlisted	166	Enlisted	159	Enlisted	76
Total	172	Total	165	Total	78
Maintenance Personnel (less 45 series)		**Maintenance Personnel** (less 45 series)		**Maintenance Personnel** (less 45 series)	
All positions	70	All positions	70	All positions	50
Maintenance sections	67	Maintenance sections	67	Maintenance sections	47
Senior NCO (E6+)	13	Senior NCOs (E6+)	13	Senior NCOs (E6+)	6
PLL Clerks	8	**PLL Clerks**	8	**PLL Clerks**	4

CSS Equipment (Current)

Forward Support Company (Armor Battalion) MTOE 63115FFCM4		Forward Support Company (Infantry Battalion) MTOE 63115FFCM4		Engineer Support Element (Engineer Battalion) TOE 63108F100	
Maintenance-Control Section		**Maintenance-Control Section**		**Headquarters Section**	
12-ton semi van, supply	1	12-ton semi van, supply	1	M1031 contact truck	1
5-ton expansible van	1	5-ton expansible van	1	M984 HEMTT wrecker	1
SAMS-1 computer	1	SAMS-1 computer	1		
Recovery Section		**Recovery Section**		**Forward Engineer Repair Sections** (3 teams)	
M88A2 Hercules	3	M88A2 Hercules	3	HSTRU trailer	3
M984 HEMTT wrecker	1	M984 HEMTT wrecker	1	Welding trailer	3
5-ton wrecker	1	5-ton wrecker	1	MTV cargo carrier	4
Service Section		**Service Section**			
M113 APC	1	M113 APC	1		
M1031 contact truck	1	M1031 contact truck	1		
Welding trailer	1	Welding Trailer	1		
2 1/2-ton truck	7	2 1/2-ton truck	7		
5-ton cargo carrier	4	5-ton cargo carrier	4		
2 1/2-ton shop vans	4	2 1/2-ton shop vans	4		
Combat Repair Teams (3 teams)		**Combat Repair Teams** (3 teams)		**Combat Repair Teams** (3 teams)	
M113 APC	3	M113 APC	3	M113 APC	3
M88A2 Hercules	3	M88A2 Hercules	3	M88A2 Hercules	3
M1031 contact truck	3	M1031 contact truck	3	M1031 contact truck	3
1/2-ton cargo carrier	3	2 1/2-ton cargo carrier	3	MTV cargo carrier	3
5-ton cargo carrier	3	5-ton cargo carrier	3	PLS transporter	3
HCMTP (FRSH)	3	HCMTP (FRSH)	3	HCMTP (FRSH)	3
Distribution Section		**Distribution Section**		**Distribution Section**	
M978 HEMMT fueler	7	M978 HEMMT fueler	9	M978 HEMMT fueler	6
M977 HEMMT cargo	10	M977 HEMMT cargo	11	M977 HEMMT cargo	3

Figure 2. Compare and Contrast - CSS Personnel and Equipment

ESE Field Test

In late January 2000, the 299th Engineer Battalion deployed to the field for 2 1/2 months of continuous field training. The primary focus of the training was the Force XXI Battle Command Brigade and Below (FBCB2) System Limited User Test. However, the 1st Brigade Combat Team saw this time as an opportunity to conduct its NTC train-up and test the new CSS redesign.

The new ESE leader came in March, with much experience under the Force XXI CSS design. Since he had previously served as a battalion maintenance officer and a support-operations officer in an FSC (supporting a maneuver battalion in the Force XXI design), he believed he knew how this element was supposed to operate. He had the concept but did not have the personnel or equipment with which to implement his plan. He discovered this the hard way when he went to the field for the first time with the ESE. Observing the engineer forward-support area and its growing unit maintenance-collection point, it became clear to the ESE leader that maintenance was the major concern for the ESE during the field exercise.

During the first week of the test, 90 percent of the battalion's armored vehicle-launched bridges (AVLBs), which drove an average of 37 miles and maintained an operational-readiness rate of about 78 percent, were parked in the engineer forward-support area and remained there for the entire field exercise. The M113 armored personnel carriers (APCs), which averaged more than 430 miles during those 2 1/2 months, suffered through an average operational-readiness rate of 78 percent.

The design faced many challenges and was off to a rocky start. One of the obvious reasons was that only one officer was responsible for the entire support system for the engineer battalion. To maintain long-term operations, it was almost impossible for him to focus on one area with any proficiency. The ESE leader thought he would be able to concentrate on the other classes of supply (I, III, and V), but Class IX and maintenance operations became the focus from day one. Managing the design places a tremendous burden and responsibility on even the most seasoned maintenance warrant officer. Additionally, the ESE had to help with maintenance on equipment such as the FRSH. The ESE had limited lift and welding capabilities but had the same amount of equipment to maintain as a maneuver battalion. The battalion executive officer, the S1, and the S4 had to turn away from their assigned duties and focus on maintenance so the ESE leader could focus on logistical support. Essentially, this pulled three staff officers away from their traditional missions and prevented the battalion from using the administrative and logistical-operations center as another command-and-control node for tactical operations.

The maintenance technician spent most of his time resourcing parts and attending maintenance meetings at the brigade support area when the executive officer wasn't available. This kept him from his job of providing technical expertise in the direct-support arena within the engineer forward-support area. The motor sergeant spent most of his time going forward to take parts to the CRT and acting as a backup for the battalion maintenance technician.

The CRTs spent more time going back to the engineer forward-support area for parts and supplies than they spent staying forward, which kept the teams from diagnosing and fixing problems in the forward area. As a result, critical systems were constantly being evacuated and returned to the fight after a lengthy stay in the engineer forward-support area—if they returned at all. Since most of the senior leadership was occupied with looking for parts and trying to manage maintenance operations, little emphasis was placed on mission-specific logistics planning for support of the battalion. The initial extended test revealed some obvious limitations in the new ESE design.

CSS Challenges

After operating for 2 1/2 months, the battalion completed an in-depth analysis of why the CSS was so challenging. The analysis was narrowed to the following areas: personnel and equipment resources, senior leadership, and the command and control within the ESE and its relationship with the engineer battalion.

Resources. With 78 soldiers authorized, the ESE is substantially smaller than the FSCs that support the armor and infantry battalions, which have 172 and 165 personnel respectively. The food-service and distribution sections in the FSCs are larger since they admittedly support larger battalions. But the disparity is not limited to these sections.

Including tanks, Bradleys, mortar carriers, command-post (CP) vehicles, and APCs, both the armor and infantry battalions have 66 tracked vehicles. The Force XXI engineer battalion also has 66 tracked vehicles: 8 M577/M1068 CP vehicles, 28 M113 APCs, 12 AVLBs, 12 M9 armored combat earthmovers (ACEs), and 6 M548 cargo carriers with Volcanos.

Similarly, armor battalions have 40 wheeled vehicles, infantry battalions have 38, and the Force XXI engineer battalion has 41. Despite comparable vehicle strengths in all supported battalions, the armor and infantry battalions are supported with 67 maintenance personnel in the FSC maintenance sections (not counting turret mechanics), while the engineer battalion is supported by only 47 maintainers—less than 70 percent of the maneuver-battalion strength. Eight Unit-Level Logistics System (ULLS) clerks support the maneuver battalions, while the ESE has only four.

The ESE also lacks the tools to support the engineer battalion, although this is mostly a supply—rather than an MTOE—issue. It has only one of three authorized common number-one tool sets. It has no FRSH or Palletized Load System (PLS) transporters (three trucks and six racks are authorized). It is also nursing three aged M88A1 medium recovery vehicles in an attempt to continue providing recovery and lift support to the battalion. This lack of tools has a direct impact on the ability of the ESE to provide responsive support. There are also MTOE disparities: the FSC prescribed load listing (PLL) sections operate out of expandable vans, have 12-ton van trailers to carry PLL, and have a SAMS-1 computer to order direct-support parts. None of these items are authorized for the PLL section of the ESE.

Figure 2, page 23, shows that, compared to the FSC, the ESE has 70 percent as many mechanics, 50 percent as many PLL clerks, and less than 50 percent as many senior NCOs. This design does not posture the ESE to successfully support an engineer battalion. These shortages cause Class IX operations to suffer, and quality assurance (QA) and quality checking (QC)—as they relate to the verification of faults, repair work, and scheduled services—are substandard. Furthermore, the requirement for these same NCOs to train and develop the junior enlisted soldiers only exacerbates the problem.

In garrison, scheduled services are conducted by the FERS, which leaves the CRTs to perform unscheduled maintenance. In the field environment, the CRTs fix forward with the supported engineer company while the FERS remains in the unit maintenance-collection point located in the engineer forward-support area to provide direct-support-level maintenance and recovery. An engineer line company CRT goes forward in an M113A2 APC, an M1031 contact truck, and an M88A1 medium recovery vehicle, while the FERS maintains a 5-ton truck and a high-mobility, multipurpose wheeled vehicle (HMMWV). The CRT that supports the headquarters and headquarters company (HHC) and ESE maintains a 5-ton truck; an M984 heavy expanded-mobility tactical, truck (HEMTT) wrecker; and an M1031 contact truck. Figure 2 shows the contrast between the FSC and the ESE in both numbers of personnel and equipment.

Leadership. The ESE has one officer authorized, compared to five officers authorized in each FSC (commander, executive officer, supply-and-transport [S&T] platoon leader, maintenance-platoon leader, and maintenance-control officer). The ESE is authorized seven maintenance leaders in the grade of staff sergeant or higher: a warrant officer and six NCOs. In contrast, the FSCs are authorized a warrant officer and 14 NCOs (13 NCOs for armor battalions). The impact of the leadership shortfall in the ESE is threefold: QA/QC is constrained, focusing on multiple missions (for example, deadlined pacers vs. services) is more difficult, and continued training of mechanics suffers. When the 45-man ESP was reorganized in January 2000 as the 78-man ESE, much of the manning fill was junior soldiers—privates and privates first class. This fill of junior soldiers made training and QA/QC extremely difficult.

Command and Control. The MTOE does not provide clear guidance for the command or management of maintenance elements within the ESE. There are five mechanics in the ESE headquarters that are responsible for maintaining the vehicles of the engineer-battalion HHC. The remainder of the mechanics are in three FERSs and three CRTs. This organization is clearly intended to support each of three line engineer companies with one FERS and one CRT. But the warrant officer and one E7 are identified by MTOE to supervise the FERSs, while the CRTs are each led by an independent E7, falling under the control of the ESE headquarters. This organization is flawed in two ways: If the three FERSs are consolidated according to the MTOE, FERS mechanics may not be responsive to the needs of the CRTs and their supported companies. However, if each FERS is under the control of a CRT chief, the ESE forfeits the ability to mass mechanics on engineer-battalion priorities.

Although a captain leads the ESE, this position is not considered a company command. The ESE is subordinate to the brigade support company (BSC) in the FSB. The ESE leader does not have the same access to the parent battalion as the FSCs supporting the maneuver battalions. As a subordinate to the BSC, which provides general support to the brigade, the ESE is subject to being tasked to support the brigade or FSCs. The ESE also remains subject to support BSC taskings and training priorities. Regardless of its desires to provide the best possible support to the engineer battalion, the ESE is bound by chains of command to support BSC ranges, formations, and inspections. The tie to a second chain of command, short-notice taskings, and required training make it difficult to make long-range plans for the ESE and to shield mechanics from outside distracters.

With the knowledge gained while in the field, the engineer battalion, along with the ESE leader, organized the ESE to best support the battalion. This organization, represented in Figure 3, page 26, creates the modularity discussed in FM 5-71-3. The company support teams are aligned to help establish habitual support and working relationships with the companies. The CRTs and FERSs are for the garrison, while the distribution and food-service sections operate under the separate section NCOICs.

Adjustments

The battalion took the shortfalls within the ESE as an opportunity to develop a feasible solution. The first barrier to overcome with the ESE was its shortage of leadership and experienced mechanics. In May, the battalion pulled a captain from an authorized MTOE slot and moved him into an unauthorized battalion-motor-officer (BMO) position to work alongside the ESE leader. The goal was to free the ESE leader to concentrate on logistics, and the new BMO would oversee maintenance operations. The BMO was in a better position to set the priorities for the battalion and provide a better conduit of information into command channels. To move the battalion forward again, a consolidated service team was created out of the FERS teams to work on scheduled services for the entire battalion and not focus on one company. Until this time, services on some vehicles were severely outdated due to the previous design of an ESP that had only 45 personnel and could barely keep up with unscheduled maintenance, much less services. The battalion—with the support of the division—was able to contract out all wheeled services, and the consolidated battalion service team focused on the tracked vehicles.

Services were now a battalion-resourced training event that was scheduled on the battalion training calendar and took priority over all other training. Platoon leaders were required to brief the battalion commander on their respective service plans.

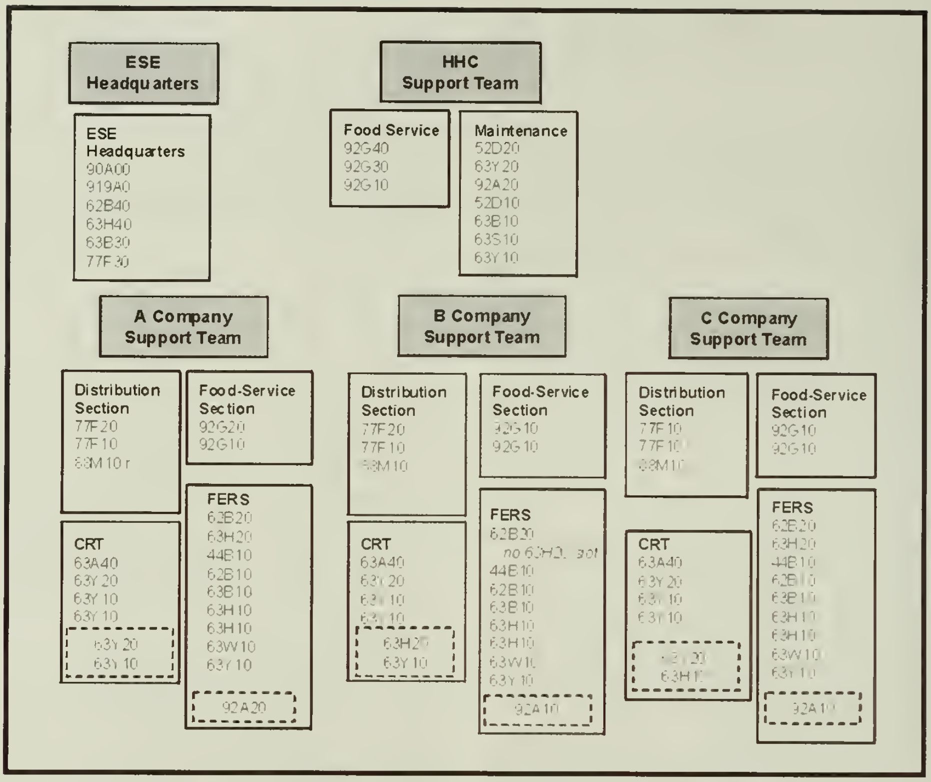

Figure 3. Manning of the Engineer Support Element Against the TOE

Between May and mid-July 2000, the battalion completed all but one line-platoon service before deploying to the NTC in August. This last platoon—deploying to the Joint Readiness Training Center, Fort Polk, Louisiana, the later part of August—conducted services to integrate new M113A3 APCs after the battalion deployed to the NTC.

Another area that needed emphasis and reengineering was Class IX operations. After the Limited User Test, the PLL section was down to three clerks. The battalion augmented the section with four military occupational specialty (MOS) 12B clerks, one from each company. This allowed the PLL clerks to concentrate on ordering parts and reestablishing the Class IX recoverable-items flow back to the FSB. With the BMO in place, the maintenance technician and the motor sergeant could get back into the "trenches," where they could direct the priorities set by the BMO and mentor the mechanics. These actions were necessary to prepare the battalion for combat operations and the upcoming NTC rotation.

Results of Adjustments

The battalion tested the adjustments made to the ESE during NTC Rotation 00-10. The NTC provided an opportunity to see if the adjustments would change the outcome from that of our experiences in the field during the early part of the year. While operating tempo was high—the M113 fleet averaged more than 317 miles, the M9s more than 302 miles, and the M548 and M1068 more than 160 miles—the results were nothing short of unbelievable!

Augmenting the structure and implementing different programs allowed the battalion to emerge out of reception, staging, onward movement, and integration with a 100 percent operational-readiness rate on all home-station combat systems (M113A2 APCs, M9 ACEs, M1068 CP vehicles, M548 cargo carriers, mine-clearing line charges [MICLICs], and Volcanoes). Throughout the rotation, there were periods (often on non-battle days) when operational readiness fell below 90 percent. However, faults were quickly identified and equipment repaired, allowing the battalion to consistently cross the line of departure with a 90 percent or better operational-readiness rate for each battle and end the rotation on training day 14 with an operational-readiness rate in excess of 93 percent.

The Solution

The ESE is not adequately resourced to provide logistical requirements unique to an engineer battalion that is embedded in a maneuver brigade. Again, the 299th Engineer Battalion—with assistance from the 1st Brigade and the 4th Infantry Division—successfully overcame these resourcing shortfalls by making the following adjustments:

- Contracting wheeled services.
- Assigning an officer out of an MTOE position to be the BMO.
- Assigning four (PLL school-trained) MOS 12Bs to augment the PLL clerks in the ESE.
- Creating a consolidated battalion service team.

However, an ESE with 70 percent of the mechanics, half the PLL clerks, and less than half the senior NCOs of an FSC remains inadequately resourced to support an engineer battalion, either in garrison or during continuous operations. The only viable option is to convert the ESE to an engineer support company (ESC) and remedy the shortfalls in personnel, equipment, and leadership.

Transitioning From ESE to ESC

With the Army's recent decision to field the Bradley to the Force XXI engineer battalions, it is imperative that we use the lessons learned from our experiences in fighting the ESE. These lessons are vital in order to identify a recommended design for an ESC that is capable of sustaining all logistical requirements of a Bradley-based engineer battalion. Figure 4 shows the major equipment found in a Bradley-based engineer battalion, as well as a comparison of equipment densities found in armor, infantry, and engineer battalions.

The recommended organization of the ESC is based on the following design considerations:

- We used doctrine (FM 5-71-3, Change 2, page 6-5) as a foundation for the proposed organization. The ESC must "*operate on a centralized CSS concept, providing all classes of supply, food service, distribution, and tactical field maintenance to the engineer battalion and to itself.*" The ESE (now the proposed ESC) must be "*capable of cross leveling between the engineer repair sections/teams to weight the main effort as logically required. The three FERSs and three engineer CRTs provide the immediate capability and task-organization flexibility to support our Force XXI engineer battalions.*"
- We examined the logistical requirements for sustaining a Force XXI engineer battalion equipped with the M2A2 Operation Desert Storm-Engineer (ODS-E) Bradley instead of the M113. Additionally, we accounted for the fielding of the Wolverine and nine additional M9 ACEs.
- We incorporated our experiences in fighting the ESE over an extended period of time in a multitude of environments.

  Experiences that highlighted the impact(s) of such things as having only four PLL clerks, being improperly equipped to environmentally protect ULLS-Ground (ULLS-G) boxes, conducting maintenance operations with a shortage of senior NCOs and mechanics, and lacking recovery and lift assets.
- We used the organizational structure of the FSC that supports a Bradley infantry battalion as the basis for our recommended organization. The reason was twofold: The engineer battalion will be a Bradley-based organization and, as an organic member of the brigade, we thought it was important that the CSS structure that supports all organic battalions be fundamentally structured the same.

Armor Battalion		**Infantry Battalion**		**Engineer Battalion**	
Tracked Vehicles		**Tracked Vehicles**		**Tracked Vehicles**	
M1064A3 mortar carrier	4	M1064A3 mortar carrier	4	M577/M1068 CP vehicle	8
M577/M1068 CP vehicle	8	M577/M1068 CP vehicle	8	M2 ODS-E	29
M113 ambulance	10	M113 ambulance	10	M113 ambulance	3
M1 tank	44	M2 BIFV	44	Wolverine	12
				M9 ACE	21
				M548 transport	6
Subtotal	66	**Subtotal**	66	**Subtotal**	79
Wheeled Vehicles		**Wheeled Vehicles**		**Wheeled Vehicles**	
Tractor/semitrailer	3	LMTV	12	HEMMT	6
LMTV	10	HMMWV	20	5-ton cargo carrier	8
HMMWV	21	Scout HMMWV	6	HMMWV	27
Scout HMMWV	6				
Subtotal	40	**Subtotal**	38	**Subtotal**	41
Total Vehicles	106	**Total Vehicles**	104	**Total Vehicles**	120
Forward Support Company Personnel	172	**Forward Support Company Personnel**	165	**Forward Support Company Personnel**	139

Figure 4. Compare and Contrast - Supported Forces (Future)

Figure 5, page 28, shows the proposed ESC design, which would increase the number of personnel supporting an engineer battalion from 78 to 139—a net increase of 61 personnel.

The headquarters platoon consists of the minimum personnel to operate a company. The addition of the executive officer, first sergeant, and operations NCOs brings the required leadership to run the company effectively.

The support platoon, made up of the food-service and distribution sections, can now coordinate efforts under the command and control of a dedicated officer and NCO to provide necessary logistical support. This is especially critical with fuel, because of the 12 Wolverines. The addition of four Load-Handling Systems (LHS) (the M985 HEMTT cargo truck replacement) will provide the capability to haul 25-millimeter ammunition and critical engineer supplies.

The maintenance platoon requires the greatest change. The maintenance-control officer and the maintenance technician can work in unison to command and control the maintenance effort and tackle critical issues. It is clear that the Bradley requires more mechanics to maintain; it takes 57 man-hours to service a Bradley compared to 7.6 for an M113, 40 for a Wolverine, and 22.2 for an AVLB. Additionally, the complexity of the Wolverine—along with the increase of nine M9 ACEs—also indicates a need for more mechanics. Three additional M88A2s (the Hercules, which is now being fielded to replace the M88A1) are in the design to allow the fix-forward concept to work. The service-and-recovery section can be the link between the CRTs and the FERSs that are located either in the engineer forward-support area or the task-force support area. They can act as a not-mission-capable vehicle-transfer point, allowing the original three M88A2 Hercules to remain forward with the supported company.

Conclusion

The current ESE structure was to be outfitted with time- and labor-saving enhancements designed to support an engineer battalion with modern equipment. Because both the ESE and the engineer battalion have not been fielded with the complete complement of enhancements and must maintain legacy equipment, the small organizational size and structure do not fully support Force XXI engineer battalions.

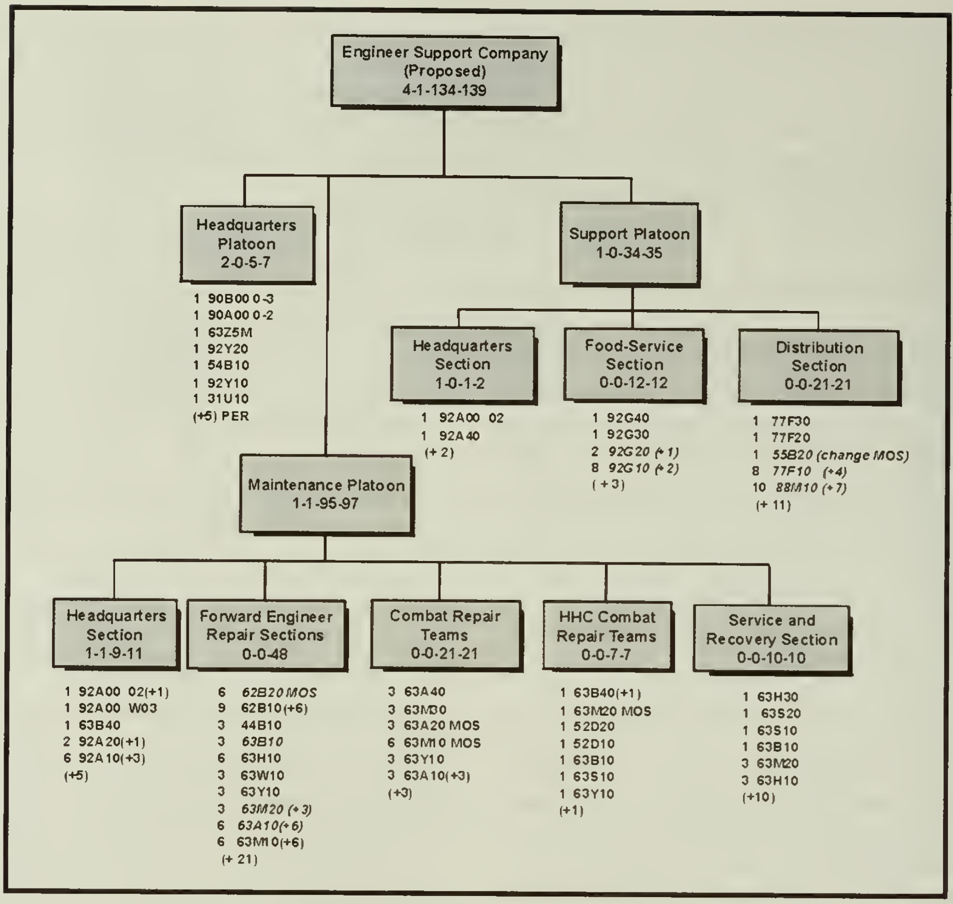

Figure 5. Proposed Engineer Support Company Structure

Because of this—and the Army's decision to field Bradleys in the engineer battalions—the structure and organization of the ESE must change; otherwise, we risk resorting to techniques that are not in consonance with the Force XXI concept.

Our experiences at both Fort Hood and the NTC proved that the ESE is still insufficient and that an upgrade of the ESE to an ESC is needed that will match the paradigm already established for infantry and armor battalions. Transforming the ESE to an ESC will—for the first time—ensure that the FSB is both properly resourced and structured to provide the logistical requirements of fixing, arming, and fueling the Force XXI engineer battalion. While many may be critical of this change, consider the following: If no adjustments are made to the CSS structure that supports the Force XXI engineer battalion, the logistician and the engineer will be placed in an untenable position. The battlefield functions of mobility, countermobility, and survivability will—at the very least—be degraded, putting at risk successful mission accomplishment and—more importantly—the lives of our soldiers. An increase of 61 personnel—with the associated equipment—is a small price to pay so that our soldiers can fight and win on the battlefields of the twenty-first century.

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Major Muraski is the executive officer for the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division (Mechanized), Fort Hood, Texas. He previously served as assistant brigade engineer, adjutant, and company commander in the 65th Engineer Battalion, 25th Infantry Division (L). MAJ Muraski is a graduate of the Engineer Officer Advanced Course; Command and General Staff College; Ranger School; and Sapper, Airborne, and Air Assault Schools. He holds a bachelor's in geology from St. Mary's University and a master's in geodesy from Purdue University.

Lieutenant Colonel Bedey commands the 299th Engineer Battalion, 1st Brigade, 4th Infantry Division (Mechanized), Fort Hood, Texas. He previously was an assistant S3 and company commander, 15th Engineer Battalion, 9th Infantry Division (Motorized); and battalion executive officer, 62d Engineer Battalion (Combat Heavy). LTC Bedey is a graduate of the Engineer Officer Advanced Course and Command and General Staff College and holds a bachelor's in construction engineering from Montana State University and a master's in construction management from Colorado State University.

The Engineer Scout Platoon: A Necessity

By First Lieutenant Jason Derstler and Captain Aaron Reisinger

> ***"...three men behind the enemy are worth more than 50 in front of it."***
>
> ***— Frederick the Great***
>
> ***Eighteenth-century Prussian king and military genius***

It was 7 February 2000, and the entire 299th Engineer Battalion was deploying to the vast wilderness of Fort Hood, Texas, to begin the train-up for National Training Center (NTC) Rotation 00-10 in August. All line and assault-and-obstacle platoons prepared for combat-engineer missions such as task-force breaches, minefield emplacements, and demolitions under the task organization of two task forces. However, while five of the line platoons deployed to the field to operate as conventional engineers, one platoon began a different journey—1st Platoon, Charlie Company, deployed as an engineer scout platoon.

The requirement for engineer scouts is well documented. For example, the Sidewinder Team Situation Report in the July 1998 issue of *Engineer* reported that, historically, brigade-directed reconnaissance-and-surveillance (R&S) plans are centered around locating enemy combat power while looking passively at enemy countermobility efforts.

The engineer scout platoon is a critical enabler to the Force XXI brigade. As the force structure of the Force XXI engineer battalion has decreased, information requirements have increased. This platoon provides the brigade commander an additional set of eyes that focus on the mobility and countermobility aspects of the deep fight. As the Force XXI engineer battalion has decreased from three to two squads per platoon and from seven to four M9 armored combat earthmovers (ACEs) per company, our reliance on situational obstacles has increased. With Force XXI enablers, we are a much more agile force. Therefore, we require agile and dynamic obstacles throughout the width and depth of the battlespace. The engineer scout platoon provides the Force XXI brigade the ability to shape enemy maneuver deep with the effective and timely employment of situational obstacles such as the Modular Pack Mine System (MOPMS), the Hornet, the air- and ground-delivered Volcanos, and the aerial denial artillery munition/ remote antiarmor mine (ADAM/RAAM). We no longer can depend on fixed conventional minefields to support a force that relies on its ability to reposition and mass at the critical point on the battlefield.

The engineer scout platoon also serves as a mobility enabler to the Force XXI brigade. Enemy obstacle intelligence is even more critical to the force than before. The loss of 30 percent of the engineer battalion's breaching assets from Force XXI redesign and the addition of the digital enablers to the force make us extremely reliant on accurate and timely obstacle intelligence. We do not have the engineer force required to sustain multiple breaches through the enemy's main defense. This platoon provides the brigade with the expert ability to conduct deep route and enemy-obstacle reconnaissance. The platoon searches out and finds either the bypass or the weakness in the enemy's defense and reports immediately to the entire brigade through our digital capabilities. This intelligence greatly increases the agility of the brigade and lessens our reliance on hazardous breaching operations.

The engineer scout platoon provides flexibility to the brigade insomuch as it can be task-organized in a myriad of ways. For example, it can be attached to the brigade reconnaissance troop (BRT) or—depending on the situation—to an individual task force. A well-integrated and -trained engineer scout platoon is required to consistently execute the brigade's deep mobility and countermobility fight. The platoons must be integrated with the BRT for all training and deployments. An organized engineer scout platoon, outfitted with the appropriate equipment and personnel, is necessary to develop the relationship with the BRT from the beginning. The BRT must concentrate on enemy combat power while the engineer scout platoon executes the deep mobility and countermobility tasks for the brigade. The critical battle tasks of the platoon are as follows:

- Execute/support situational-obstacle emplacement.
- Conduct engineer reconnaissance (route and enemy-obstacle).
- Conduct a covert breach.

Integration With the BRT

During the 299th Engineer Battalion's last experience with the engineer scout platoon, we did not fully integrate the platoon with the BRT. The shortfalls that occurred because of this led to emphasis on early and complete integration between the two elements. Specific examples of problems that occurred included battlespace-management conflicts that almost caused fratricide. Enemy triggers for situational obstacles were also difficult to accomplish because the platoon provided its own eyes forward. To remotely activate a Hornet munition, 36 minutes must expire between the time a soldier sends a code on the M71 Remote-Control Unit (RCU) and the time the mine is armed. This time standard was not met at times because the team did not identify the enemy movement soon enough. Because of these lessons, the leadership committed to establishing a habitual training relationship between the platoon and the BRT.

Since all of the soldiers in the engineer scout platoon were military occupational specialty (MOS)12B engineers and had never participated in scout operations, the train-up for the NTC had to begin from step one. We not only had to create a working tactical standing operating procedure (TACSOP) for our NTC rotation and beyond but also integrate into the daily operations of the BRT, tactically and socially. The BRT is an aggressive and close-knit cavalry scout (MOS 19D) organization that had never operated with an engineer unit attached to it for training. We had to prove that we could perform our engineer missions competently without compromising the BRT or ourselves while operating close to or behind enemy lines. In a matter of months, our platoon had to transform from a mobility-focused mechanized line platoon to an M998 high-mobility multipurpose, wheeled vehicle (HMMWV)-mounted scout platoon capable of covert operations.

The train-up began by conducting fire-support training with the Striker platoon and scout operations with the two scout platoons. We began and finished our train-up with 19 soldiers plus a medic, 3 HMMWVs, and an M923 5-ton cargo truck. Two weeks of platoon- and BRT-level training opened our eyes to the scout world. Before we could begin to execute our engineer missions, we had to learn scout tactics such as establishing observation posts (OPs); performing mounted and dismounted tactical night movements; and conducting actions on contact, tactical resupply, and casualty evacuation forward of the forward line of own troops (FLOT). These skills laid the foundation for how we would perform our engineer-specific missions. Once we felt comfortable operating as scouts, we began to integrate our engineer missions into the overall BRT missions.

The missions started off simple but became more complex as our abilities and knowledge increased. Our first missions were for mounted squads to set up a single MOPMS, establish an OP, emplace Hornet mines in 5-to-10-munition clusters or gauntlets, and set up overwatch. Once we understood how to emplace both mine systems while mounted, we began to operate with dismounted teams. We discovered that carrying five Hornets with a three-man dismounted team was the effective limit. When one soldier carried the team's Single-Channel, Ground-to-Air Radio System (SINCGARS), the M71 RCU, and one Hornet and the other soldiers carried two Hornets (at 35 pounds each) and their personal equipment, the weight became a limiting factor. We had to find a balance between setting up an effective obstacle and maintaining our ability to move tactically behind the enemy. When a squad (two teams) operated with the HMMWV, we could carry up to 10 Hornets and a MOPMS or 2 MOPMSs without the Hornets.

Because of the amount of equipment we were required to carry, the operational load plan changed daily. However, by the end of the train-up, we established the load plan and incorporated it into our TACSOP. The key was proper utilization of our 5-ton truck. Although this truck was not used as an infiltration vehicle, it proved to be a great asset for maneuvering equipment loads back and forth based on a thorough mission analysis. After a mission, we would reconsolidate at a BRT assembly area. Upon receiving the next order, we could switch equipment and place all the excess on the truck.

After effectively training on our countermobility mission of emplacing situational obstacles, we trained on our mobility mission of reconnoitering complex obstacle belts with enemy overwatch. We set up lanes with one team building an obstacle and set up an overwatch position with another team performing route reconnaissance and attempting to conduct a covert breach on the obstacle. The teams were tasked to identify all intelligence requirements and then wait for permission from higher headquarters before breaching, thus duplicating the process during actual operations. Often, the team simply marked the proposed breach site and called in eight-digit grids. Since

FM 90-13-1, *Combined-Arms Breaching Operations*, describes covert breaching by a squad or platoon, we had to develop an SOP for a three-man breach.

After conducting weeks of covert-breach training, we discovered that it could be inherently dangerous yet rewarding. In a covert breach, there is no suppressive fire. The three-man team works independently, so stealth is the team's only security. We assigned two teams to an individual breach location so that one team could overwatch the breach activities of the second team and provide backup in case of casualties. This allowed the primary team to focus on breaching and marking the obstacle quickly and effectively. The overwatch team would alert the breach team of enemy compromise at night by signaling with an infrared flash from their night-vision goggles. The last member of the breach team would scan his rear sector with goggles every 10 to 20 seconds to acquire the set signal. After receiving this message, the breach team moved off the obstacle and reconsolidated at a predesignated rally point away from the overwatch team. Once the breach team successfully broke contact and arrived at the rally point, a decision based on the enemy situation was made as to where the two teams would link up.

The end state of conducting obstacle reconnaissance and covert-breach training was that our main focus needed to remain on providing an accurate enemy-obstacle picture to the maneuver-brigade and engineer-battalion commanders. The ability to execute a covert breach was definitely an asset but remained secondary to the primary mission. Most of the time, we provided suggested points of penetration (eight-digit grids) based on our reading of the obstacle and enemy combat power. We could then conduct dismounted maneuver past the enemy minefield and emplace situational obstacles to disrupt the repositioning of enemy forces along key avenues of approach.

Early in the train-up of the engineer scout platoon, we experimented with scout-team organization to determine what would provide the most flexibility in emplacing effective shaping obstacles. During our early missions, we only split into three teams. However, as the capabilities of our platoon increased and our specialists and sergeants became more confident, we transitioned to a six-team organization. (See Figure 1; each box represents a team.) This allowed for three mounted and three dismounted OPs consisting of two to three soldiers each. With a total of 3 MOPMS, 20 Hornets, and 6 antitank weapons at our disposal, each team was capable of disrupting 3 to 4 tracked vehicles. Additionally, the soldiers in obstacle overwatch were able to call for fire and, therefore, were able to disrupt a company of tracked vehicles at any one of our six locations on the battlefield. On two occasions during the train-up, we were able to disrupt and destroy the entire combined-arms reserve. We had now established that the optimal disrupt obstacle could be achieved by a dismounted team placing five Hornets or one MOPMS at a choke point tied in with indirect fires. Our task organization and employment methods made the engineer scout platoon a true enabler to the brigade fight, not only increasing intelligence collection and situational awareness but also providing a means to affect the enemy's decision cycle.

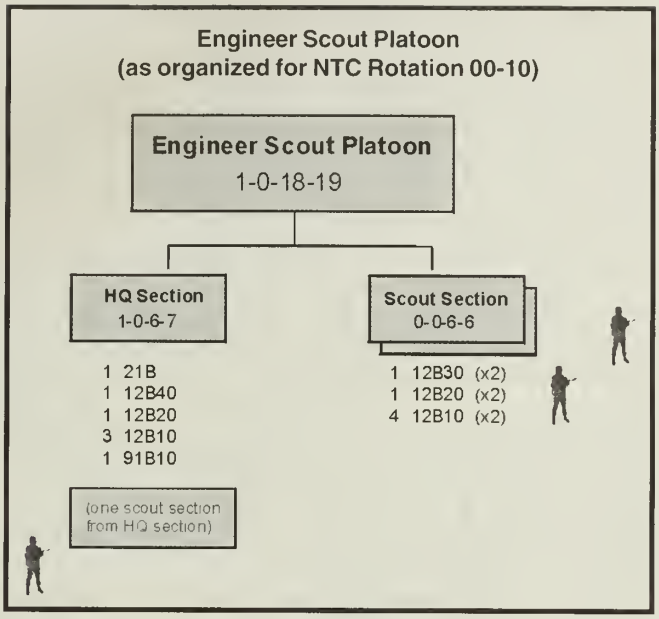


Figure 1

The Optimal Scenario

We discovered that situational obstacles, along with indirect fire and antitank weapons, could create an extremely effective engagement area. In the optimal countermobility scenario, we would establish the engagement area at a choke point that restricted enemy-vehicle movement to columns. For each identified targeted area of interest (TAI)/ engagement area, the BRT would establish a named area of interest (NAI) that supported the situational-obstacle trigger. The BRT team position was usually 5 to 10 kilometers in front of our engineer OP, providing the required early warning (accounting for the 36-minute remote arming time on the Hornet). Upon identification of enemy vehicles in the NAI, the overwatching BRT leader would send in reports through the BRT radio net, which the leader of the engineer scout platoon would monitor. If the enemy spot report met the established trigger, the platoon leader would alert the engineer team observing the associated TAI and request obstacle-emplacement approval from the brigade tactical-operations center (TOC).

Once approved, the platoon leader would direct the engineer scout team to deploy the minefield. As the lead enemy vehicle was destroyed by the Hornet or MOPMS strike, the engineer scouts would fire antitank-4s/Vipers at the last vehicle in the column. With the column halted, the engineer scouts would call indirect fire on the preset target reference points to destroy the remainder of the enemy vehicles. Any other vehicles that attempted to bypass the destroyed vehicle would be hit with the remaining Hornets and MOPMSs.

After completing a countermobility mission, the teams would maintain their OPs and continue to call in enemy situation reports. If a Hornet or MOPMS was not deployed, recycle approval would be requested through the brigade until the battery life of the munition expired. Figure 2, page 32, shows the reporting channels.

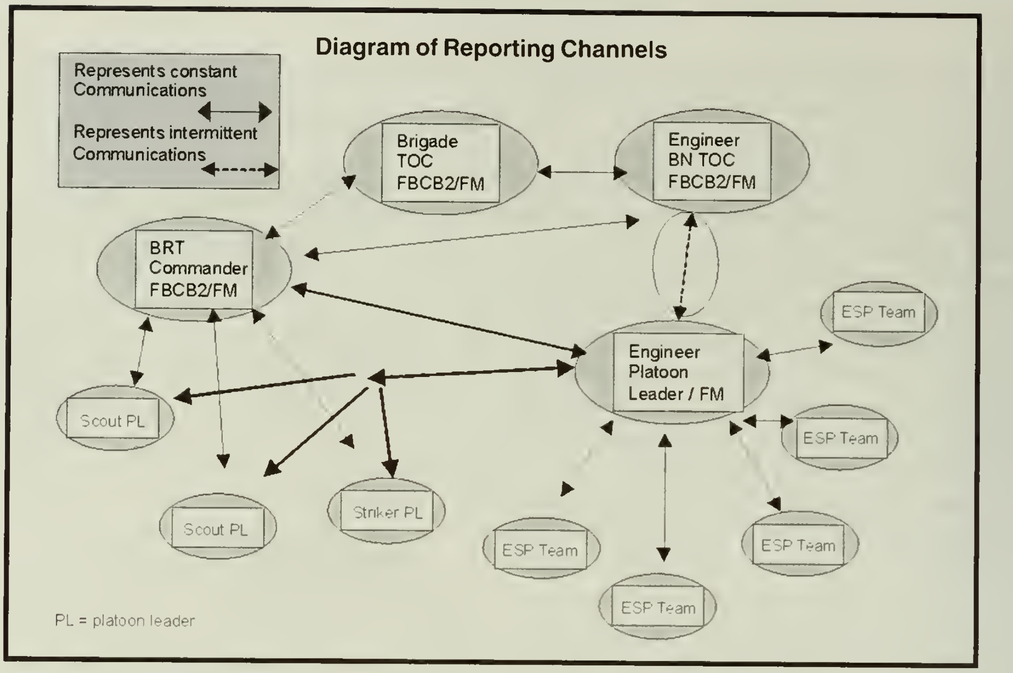


Figure 2

Integrating Into the Brigade R&S Plan

While we grappled with mastering our basic skills, the engineer plans team developed methods for integrating us into the brigade fight. During the military decision-making process, the assistant brigade engineer (ABE) section worked directly with the brigade plans team to create and assign our missions. The ABE section consisted of a captain and a first lieutenant. The ABE concentrated on the terrain analysis and enemy-engineer analysis to support the engineer-scout planning and integration during the war-gaming process. The deputy ABE worked closely with the R&S and fire-support (FS) planners to integrate the engineer scouts into the R&S and FS annexes. The deputy ABE worked the details of safety/danger zones, priority-of-information requirements (PIR), triggers, OP and target locations, fire planning to support situational obstacles, and the reporting and tracking process.

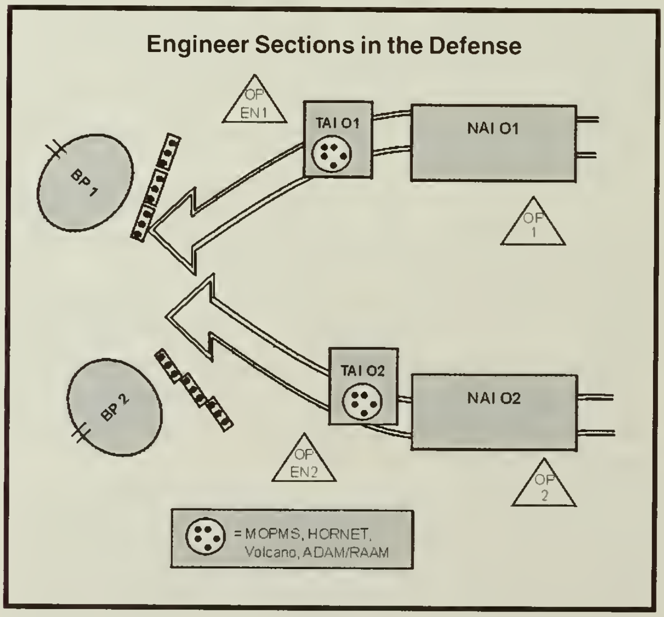

Engineer Sections in the Defense
OP EN1
TAI O1
NAI O1
BP 1
OP 1
TAI O2
NAI O2
BP 2
OP EN2
OP 2
= MOPMS, HORNET, Volcano, ADAM/RAAM

Figure 3

A thorough engineer-scout intelligence preparation of the battlefield (IPB), a solid working relationship within the brigade planning cell, and a brigade commander that supported the engineer-scout concept led us to effectively integrate the engineer scout platoon into the brigade fight. We used a basic approach for developing missions for the platoon. During defensive missions, we concentrated on meeting the intent of the brigade commander's deep fight (see Figure 3). Based on thorough terrain analysis and understanding how the enemy would fight, we assigned brigade-directed situational obstacles to disrupt enemy maneuver deep. The situational obstacles, coupled with an effective indirect-fire plan, proved a deadly deep shaper. During the war-game process, we focused on either taking an enemy course of action away, disrupting an enemy element long enough to cause him to piecemeal his attack, or mitigating risk by employing the engineer scouts at a location where the brigade commander was taking a maneuver risk.

The keys to defensive planning for the engineer scouts were—

- Analyzing the terrain (pinpointing the best location to attack maneuver and conducting time/distance analyses).
- Establishing an effective surveillance plan (identifying the required NAIs, PIRs, and triggers).
- Integrating the engineer scout plan with the R&S and FS plans.
- Briefing the brigade situational-obstacle plan at the brigade operations-order briefing.
- Reporting via FM radios and the Force XXI Battle Command Brigade and Below (FBCB2) System.

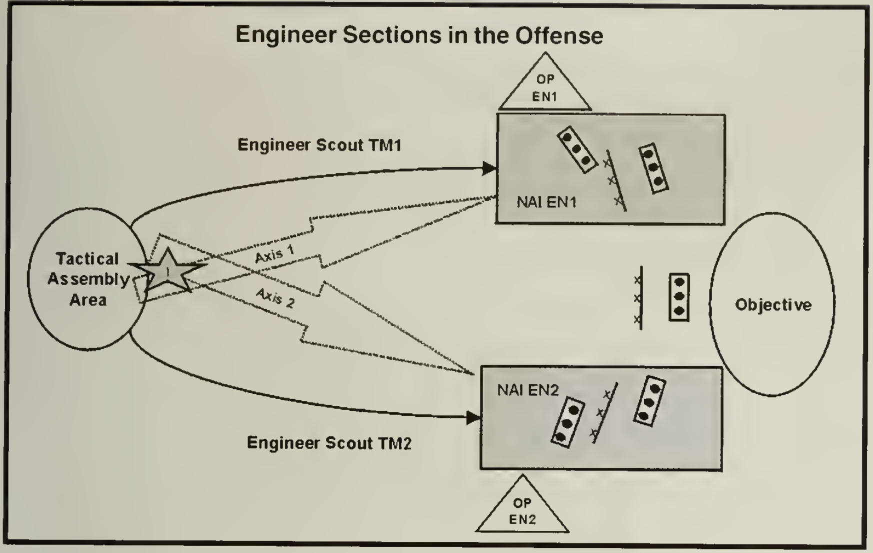


Figure 4

The ability of the engineer scout platoon to attack enemy maneuver deep with either the Hornet, MOPMS, or ADAM/RAAM and/or the air-delivered Volcano gave the engineer planners numerous effective options when planning the defense.

When the brigade went on the attack, we changed the focus of the engineer scout platoon (see Figure 4). After the S2 and the ABE templated the enemy battle positions and obstacles, we proposed possible points of penetration. These points became targets for the engineer scouts. We established NAIs on the points of penetration and assigned them to the platoon. It was the responsibility of the engineer scouts to confirm or deny the planners' template of the enemy obstacle belt. Additionally, the engineer scouts were to provide detailed information such as soil conditions, picket spacing, tank-ditch depth, mine types, and obstacle orientation and configuration. This information was critical in determining exactly how to attack the obstacle—either with mechanical, explosive, or manual means—or bypass it.

We also used the engineer scouts to conduct reconnaissance of routes, fording sites, and natural obstacles forward of the FLOT during the attack. Normally, the brigade had a follow-on mission to establish a hasty defense after a successful attack. After the reconnaissance mission was completed, we planned for the engineer scouts to employ situational obstacles on the brigade's flank to protect against counterattack or to move deep and prepare to employ air-delivered Volcano or ADAM/RAAM to disrupt counterattacks along high-speed avenues of approach.

Movement to contact was approached in much the same way as the defense. However, instead of using the engineer scouts strictly to attack enemy maneuver, we also planned for the scouts to go deep to prepare situational obstacles that we could eventually fight from, with maneuver forces moving forward in the zone. The engineer scouts gave the brigade planners a tool to disrupt enemy maneuver long enough to allow friendly forces to gain critical terrain and establish support-by-fire positions.

Two inherent risks were associated with the movement to contact: survivability of the air-delivered Volcano and prevention of fratricide as friendly forces moved forward into the zone. To mitigate the air-delivered Volcano risk, we ensured that engineer scouts were on the ground in the vicinity of the target location and in direct contact with the aircraft. The engineer scouts verified the location of any enemy forces to the pilots and helped verify the employment of the Volcano. The FBCB2 System allowed us to mitigate the fratricide risk. As the engineer scouts employed a scatterable-mine system, the obstacle was added to the graphics on the FBCB2 System's map screen. Immediately, every combat system in the zone had the obstacle on its map screen and knew the obstacle's location.

The engineer scout platoon developed into a powerful tool for the brigade plans team. The platoon was always a focus of the brigade's deep fight. It allowed engineer planners to truly plan throughout the width and depth of the battlefield. The platoon also greatly enhanced our flexibility; we were able to plan for up to six teams, each with its own target. Planning for the platoon depended on a thorough IPB process. Analyzing the terrain, understanding enemy capabilities and order of battle, and knowing the engineer-scout capabilities were critical to the planning process. Because we integrated the platoon 6 months in advance of our NTC rotation, both the brigade and engineer planners had a clear understanding of the platoon's capabilities.

Lessons Learned

Overall, the 6-month train-up was an essential element to developing the TACSOP for operations at the NTC and future combat operations. Because of the lack of doctrine on engineer-scout operations, each unit should experiment with developing, outfitting, and training before going to the NTC.

An essential upgrade that we did not have during the train-up, but used at the NTC, was the .50-caliber machine-gun mounts on our HMMWVs. This addition to our vehicle load increased our survivability and allowed us to repel attacks from enemy counterreconnaissance efforts as we traveled into sector.

The 5-ton cargo truck was another critical element to our success. We could carry our mission-essential equipment on our load-plan-challenged HMMWVs and place everything else on the truck, which was operated by the platoon sergeant.

An important change that began to take place toward the end of the train-up and into the NTC rotation was the use of brigade aviation assets to emplace engineer-scout-platoon teams. Once aviation assets became available on a regular basis, we used them to place teams at key terrain features much faster and safer than before. This became our preferred method of

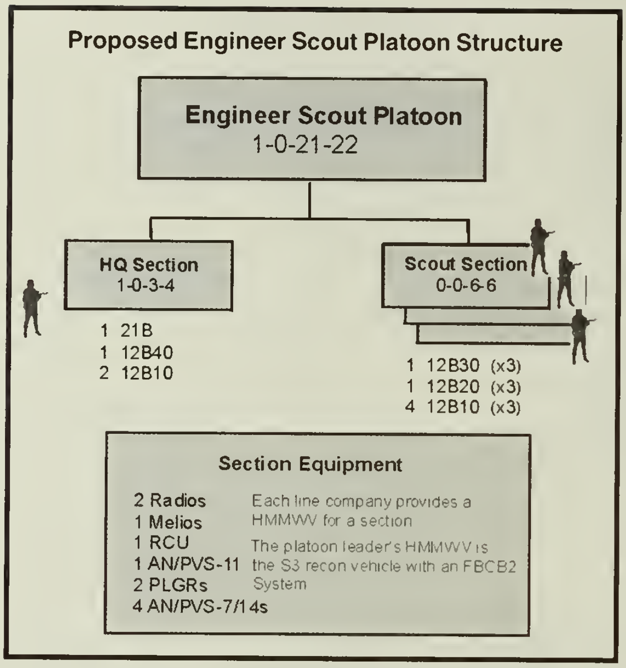


Figure 5

insertion and allowed us, on occasion, to get deep enough to sabotage Class IV/V sites before the enemy began to set up his obstacles. This method of inserting teams also was the best tactical solution in a countermobility mission of shaping the deep battlefield.

One addition that must be included in the scout vehicles is the FBCB2 System. With the SINCGARS, we could not communicate while on low ground or 20 kilometers from the engineer TOC. The ability to instantaneously communicate reconnaissance information to the brigade while located anywhere on the battlefield would allow engineer planners more time to possibly change the existing plan and breach another location. It would also ensure 100 percent accuracy of detailed intelligence from the scout with eyes on the obstacle to the ABE or brigade engineer.

Another improvement would be to increase the number of HMMWVs from three to four while maintaining the 5-ton truck. This would allow each operational scout section to have a HMMWV and allow the platoon leader to maintain the command post without deploying a squad and losing communications with other teams.

Although we operated with 19 soldiers plus a medic, the ideal task organization requires three more soldiers. Three HMMWVs with six-man sections in each; another HMMWV with the platoon leader, driver, and a gunner; and the 5-ton truck with the platoon sergeant, driver, and medic would bring the total number necessary to 1/0/21/22. We believe this organization is ideal and provides the most flexibility and redundancy while remaining small enough to operate covertly.

Proposed Engineer-Scout Platoon Structure

The 299th Engineer Battalion is now fielding an engineer scout platoon as detailed in Figure 5. This 22-soldier platoon is a major enabler in the Force XXI organization proposal. The battalion has resourced the additional personnel from the newly authorized eight-man assault sections in each assault-and-obstacle platoon. Each line company transferred equal equipment to the headquarters and headquarters company (HHC), including a HMMWV from each of the line platoons. Weapons, along with essential equipment, are under the control of the HHC commander and the scout-platoon leader. These scout sections now have the ability to support a task force operating independent of the brigade alongside its parent line company or consolidate alongside the BRT.

Conclusion

The most important aspect of creating an effective engineer scout platoon is the training and relations with the brigade and/or maneuver scouts. The fact that we were able to learn the right way to operate as scouts before we started anything else helped us establish a solid relationship with the BRT and build the correct foundation to accomplish complex missions. We struggled at times and shined during others, but throughout the entire process, the BRT was our mentor. After 7 months of training together, we gathered as one team 2 weeks before leaving for the NTC at the emotional BRT dining in and earned the distinction of being the first engineers to add sapper ingredients to the troop grog. That July night truly defined the lasting and trusting relationship that had been built and was pivotal to our joint success at the NTC.

Engineer scout teams can be incredible assets. With a modified table of organization and equipment proposing to field 22 scout positions and continue to train engineer scouts with the BRT, the emergence of these teams in doctrine is certainly very close. From this point, more efforts from other battalions need to be attempted to validate our concepts. The more that the armor and infantry communities put eyes on what these teams can accomplish at the major training centers—and possibly in combat—the greater the future of engineer scouts will become.

First Lieutenant Derstler, the executive officer for A Company, 299th Engineers Battalion, was the engineer scout platoon leader during NTC Rotation 00-10. A graduate of the Ranger Course, he holds a bachelor's in mechanical engineering from the Illinois Institute of Technology.

Captain Reisinger, commander of C Company, 299th Engineer Battalion, was the 1st Brigade assistant brigade engineer during NTC Rotation 00-10. Previously he was assigned to the 14th Engineer Battalion, Fort Lewis, Washington, where he served as a platoon leader, executive officer, and battalion maintenance officer. A graduate of the Ranger Course and Engineer Officer Advance Course, CPT Reisinger holds a bachelor's in mechanical engineering from West Point and a master's in engineering management from the University of Missouri-Rolla.

554th Engineer Battalion—

Looking for Outstanding Officer Platoon Trainers

By Captain Kristy Wolfe

The 554th Engineer Battalion at Fort Leonard Wood, Missouri, is seeking highly qualified first lieutenants and captains to serve as Engineer Officer Basic Course (EOBC) platoon trainers for 8 to 12 months, or at least two full 17-week cycles. We need quality officers to coach, mentor, and develop our junior leaders to ensure the continued success of our Regiment. We need officers who are dedicated to serving the Engineer Regiment and the United States Army. Our officer platoon trainers must be the best of the best. They must be tactically and technically proficient, have a sound understanding of Army doctrine, and care about the future leaders who will take forth our Regiment. A lieutenant's initial professional development depends highly on the officer platoon trainer.

To emphasize the importance of the officer platoon trainer position, let me first explain their duties and responsibilities. Platoon trainers are responsible for 40 to 70 lieutenants; logistical and administrative support to facilitate training; coaching, mentoring, counseling, and teaching; planning and conducting soldierization training, to include basic rifle marksmanship (specifically range operations), physical training, and drill and ceremony; planning, conducting, and evaluating field and situational training exercises; evaluating lieutenants on their performance; and serving as subject-matter experts in all facets of engineering, from bridging to combat engineering to construction. On any given day, officer platoon trainers may find themselves evaluating a student-taught physical-training session; answering questions about follow-on assignments; discussing the tenets of breaching; or planning an upcoming Sapper Stakes competition—all while managing a myriad of other tasks. The students respect the knowledge of the officer platoon trainer and use it to better prepare themselves as future platoon leaders.

The ideal officer platoon trainer has served at least 12 months as a platoon leader and 6 months as a company executive officer and has some battalion-staff experience. In addition, we also need a mix of combat, combat-heavy, bridging, topographic, and light-fighter experience. The students, much like the platoon trainers, come from distinctly varied backgrounds, to include the U.S. Army Reserves, the Army National Guard, the Reserve Officer Training Corps, the Federal Officer Candidate School, or the U.S. Military Academy. The conglomerate of students makes the job of a platoon trainer nothing short of interesting. Therefore, the experience brought by the officer platoon trainers needs to be as diverse as the lieutenants they are responsible for training.

So why does it benefit you to volunteer to be an officer platoon trainer? First and foremost, you are shaping the future of the Engineer Regiment. The lieutenants you mentor and train are your future platoon leaders. You can personally impact the quality of officers in our Regiment. Secondly, you will be able to refine the skills you may have lost since the basic course. For instance, if you served in a combat mechanized battalion for 4 years, your construction skills may be lacking. By working with the basic-course students, you are able to redevelop those skills, which may be exactly what you need for your command. Finally, you get the opportunity to work with individuals from the U.S. Army Engineer School. Being at the home of the engineers, you can make some great contacts here that will benefit you during your command tenure.

Please understand that if you volunteer to serve as a platoon trainer, it will NOT be a PCS move to Fort Leonard Wood. You will still be under a PCS status to attend the Captain's Career Course, but your follow-on assignment will not be affected.

As you can see, Engineer Officer Basic Course officer platoon trainers play a formidable role in the development of newly commissioned engineer lieutenants. Platoon trainers are extremely influential figures to second lieutenants as they begin their diverse careers in the Corps of Engineers. Platoon trainers develop and train these new officers. Whether they are active duty, National Guard, Reserve, or international officers, the 554th Engineer Battalion prides itself in developing the best lieutenants in the military. If you are interested in becoming a platoon trainer before attending the Captain's Career Course, please contact the battalion executive officer at (573) 596-0787 or DSN 676-0787. For more information on the 554th Engineer Battalion, go to its Web site at *http://www.wood.army.mil/554th/554.htm.*

Captain Wolfe is the commander of A Company, 554th Engineer Battalion, Fort Leonard Wood, Missouri.

The Grizzly: A System of One

By Colonel Michael K. Asada, Lieutenant Colonel Theodore L. Jennings Jr., and Wesley L. Glasgow

The Grizzly, a critical complex-obstacle breaching system for the twenty-first century, is nearing the end of its developmental phase in the acquisition cycle and remains at risk for continuation due to funding priorities. The system promises to become one of the Army's most versatile and important combat-support vehicles to the maneuver commander. The Grizzly's technology also has the potential to enhance future Objective Force equipment performance. It is the only system directly designed to facilitate the rapid and decisive movement of combat forces through even the most complex engineering obstacles. The system is vital to U.S. forces because rapidly emplaced complex obstacles are a low-cost means—and perhaps the most effective mechanism—the enemy can employ to shape the battlefield and frustrate U.S. operational objectives. Skillful employment of these obstacles can erase the effectiveness of millions of dollars invested in winning the information war and impeding the key U.S. battle objective of ***dominant maneuver****. Formidable obstacles at the right time and place can severely hamper friendly-force momentum, and their reduction—using the current suite of breaching equipment during battle—ultimately means lost time and heavy casualties. Today's breaching capability, without the Grizzly, is only marginally adequate for conducting deliberate or hasty attacks and cannot be executed without losing the momentum needed to support future heavy- or medium-brigade operations. The Grizzly, however, has specialized equipment, mobility, and protection that enable it to be an integral part of the combat team, preserving the commander's flexibility and preserving dynamic maneuver options for the Legacy, the Interim, or the Objective Force.*

Despite the dramatic successes of Field Marshals Rommel and Zhukov, General Patton, and others in the employment of armored forces in World War II, U.S. Army officials in a postwar assessment observed one glaring weakness in the use of these forces when they commented, "In the end… an armored force that encountered a minefield usually had to attack at the pace of a crawling soldier."

Although huge strides have been made in the effectiveness of armored warfare since World War II, one area that has not improved much is the stultifying effects of the properly emplaced minefield on mechanized maneuver. Complicate minefields with other obstacles—such as wire entanglements, antitank ditches, natural and devious man-made devices—in the right place, and even the most powerful tank will have its greatest asset—mobility—slowed or reduced to a standstill.

These combinations of "reinforcing" obstacles, called "complex obstacles," are deliberately designed to force the enemy either to bypass them or devote time, personnel, and equipment to defeating them. Depending on the scope and location of the obstacles and how they are defended, the enemy hopes to force high casualties on the assault force, or worse, completely defeat the breach attempt. Or the obstacle could be a means, possibly the only means, for the enemy to buy time—to retreat, to reinforce, to counterattack elsewhere, or even to sow frustration and impatience in the mind of the American public.

The Bypass Decision

Obstacle complexes are serious impediments to maneuver. The Army's approach to obstacles is to bypass them or, if that is not possible, to conduct a breach to support either a hasty or deliberate attack. Either type of breach features a common sequence of events. Each begins with a near-total cessation in momentum as the commander discovers the obstacle (often when the lead element encounters a mine). The next step is to marshal intelligence about the defenses and scope of the obstacle and assemble the right breach equipment and trained elements to cope with it. These assets may be ready at hand, "one terrain feature back," or perhaps days, even weeks away from ready use. Chances are that the commander's proximate combat units are not fully up to the task for the larger obstacles faced, so he must call on trained engineer soldiers to get the task done. If he is lucky, these soldiers are ready at hand with the right equipment to conduct a breach and not slow the momentum of the attack. If not, or if the complex obstacle is too extensive, the task devolves into a more difficult breaching operation. Meanwhile the momentum of the armored thrust is stalled, and the task organization is literally moving at or less than the "crawling-soldier" analogy—often because exposed soldiers are actually

> **“The maneuver force still has a valid requirement for (the) Grizzly, especially the Counterattack Force.”**
> **—Mechanized Force Modernization Plan**

crawling through the obstacle carrying explosives or probing for mines with a bayonet to create a lane.

A breach in support of a deliberate attack is one of the hardest and most complicated tactical operations a commander faces because of the difficulty in successfully synchronizing and protecting the unique assets needed to execute the breach. The resources required are also costly to the maneuver commander in terms of combat power. For example, an armor battalion employing the Battalion Countermine Set (BCS) of special plows and rollers requires that 30 percent of its combat assets be directly dedicated to the task in addition to the engineer breaching assets needed to clear two lanes successfully. Much more is needed to suppress enemy fires or seal off the area so the operation can proceed.

Historical Obstacles

Breaching obstacles to support deliberate attacks is nothing new. It has always been the bane of maneuver. Without freedom to maneuver, the course of the campaign or even the entire war can be decisively impacted. One doesn’t need to go far to observe the historical significance of obstacles and fortifications. Medieval fortresses often frustrated campaigns of warrior kings when no means was available to defeat them. Robert E. Lee’s Army of Northern Virginia arguably extended the American Civil War 2 years with the tenacious use of simple field obstacles. Kaiser Wilhelm II expended the flower of his army in the futile attempt at battering through the Verdun fortified zone in World War I. The significance of the French Maginot Line was not lost on the Germans in 1940. Unfortunately, the line didn’t extend into Belgium so the Germans simply bypassed it. Would Rommel have stopped at El Alamein and waited for the inevitable British buildup, or could he have pushed to Suez if a ready means to pierce the obstacles without losing momentum had been at hand? Might the greatest tank battle ever fought—Kursk—have turned out differently if the German Army Group South could have rapidly and decisively dealt with Zhukov’s Russian obstacle belts? Even the prospect of high casualties in defeating Saddam Hussein’s obstacle belts on the Kuwait frontier in the Persian Gulf War gave pause and caused allied leaders to shift large forces far to the west. Obstacles have had and continue to have a profound effect on tactical and even strategic operations.

Does the situation improve with the recent development of a lighter-force concept? Unfortunately, no! The lighter, enhanced mobility systems will still be stopped dead by complex obstacles that will still have to be dealt with by the crawling-soldier approach. The promise of greater speed and agility of U.S. forces ironically means a likely adversary will employ more obstacles with greater sophistication to remove the U.S. speed and knowledge advantages.

Fortunately, the situation is not hopeless. A system is being developed today with the promise to breach even the most complex obstacles without losing momentum—the Grizzly Combat Obstacle Breaching System. The Grizzly is a vital element to the combat force. As stated in the Mechanized Force Moderization Plan, “The maneuver force still has a valid requirement for (the) Grizzly, especially the Counterattack Force.” However, at the drafting of this article, its future remains unclear because of funding priorities. If the Grizzly program is funded this year, and the program is allowed to continue, its employment promises that the lethal and agile mechanized force of today’s and tomorrow’s Army can progress beyond the crawling soldier and fully exploit dominant maneuver. The technological advances included in the Grizzly design may also have application in systems being developed in the Army’s Transformation.

The Grizzly promises the versatility and capability to finally permit the dismounted soldier or sapper to sheath his antimine bayonet. It allows the armored force to counter the delay tactics of the enemy commander and multiplies the effects of our impending revolution in digitization and situational awareness. The system is absolutely essential in permitting the Army to accomplish its operational objectives.

Capabilities and Mission

The Grizzly (shown in the photo on page 38) is specifically designed to breach simple and complex obstacles without losing momentum, a capability simply nonexistent in any single vehicle today. The vehicle incorporates both countermine and counterobstacle capabilities into a single survivable system that, in a single pass, creates a full-width assault “lane” that is immediately trafficable by the entire maneuver force.

The Grizzly defeats a wide range of obstacles, to include natural obstacles (streams, dry gaps, rocks/boulders, and fallen trees), simple/man-made obstacles (wire, bomb craters, berms, abatis, rubble, and constructed structures such as log cribs, antitank ditches, and minefields), and complex obstacles (combinations of natural and simple obstacles in mutually reinforcing arrays).

The Grizzly is a full-tracked, heavily protected vehicle that can go into harm's way far better than the specialized engineer obstacle equipment now in use. It integrates M1 Abrams main battle tank chassis technologies, the latest Army communications components to instantaneously broadcast its progress in the lane, and its unique Grizzly mission modules. Mobility is equivalent with the M1 tank, and survivability features include an overpressure collective protection system for nuclear, biological, and chemical operations. It employs a wide variety of standard combat-vehicle components integrated into the system through an aggressive technology-insertion initiative. The Grizzly has an integrated open-systems vehicle electronics (Vetronics) architecture that includes the very first "drive-by-wire" controls; a mine-clearing blade equipped with terrain-following, automatic depth-control sensors and controllers; a power-driven arm for obstacle reduction; and a sophisticated vision system for operating the Grizzly in the "closed-hatch" mode. The technology associated with the Vetronics and depth-control sensors may have application to other systems being developed for the Objective Force.

Laws of Physics

The development of the Grizzly's design centers on meeting clear operational requirements based on known deficiencies existing in current methods and equipment. The Grizzly is designed to clear—within 21 minutes—a full-width lane (analogous to a wide pathway rather than two separate left- and right-side wheel tracks) through a designated complex-obstacle system of 600 meters in depth (length) that includes antipersonnel wire, an antitank ditch, and antipersonnel and antitank mines laid to standard densities and depths. Its mobility and survivability correlates with that of the heavy mechanized force, and while its weight approaches the 70-ton gross-vehicle-weight threshold, this size and the power of the Abrams suspension components are absolutely essential for the Grizzly to achieve the mechanical forces necessary to remove deeply buried mines (greater than 12 inches in depth). The laws of physics dictate the requisite inertia necessary to achieve this level of performance. Therefore, a lighter vehicle simply cannot physically generate enough plow force to clear mines without sacrificing much of its weight for power or without sacrificing survivability.

A Grizzly perfoms a mine-plowing mission.

The tactical advantage afforded by the Grizzly's survivability and mobility is enormous. It permits the maneuver commander to employ the Grizzly at or near the very forefront of the battle. As obstacles are encountered, the unit can immediately employ relatively simple Grizzly battle drills to counter the obstacle while the armored forces cover the breach site with appropriate fires. Even before the breach is completed, tanks and armored vehicles can follow right on the heels of the Grizzly. This tactic would be particularly effective against the artillery- or air-delivered scatterable minefields the enemy desperately employs to impede our advance. Many significant advantages result from this capability, as shown in a likely scenario in the inset on page 39 compared with today's tactics, techniques, and procedures.

The Orchestrated Ballet

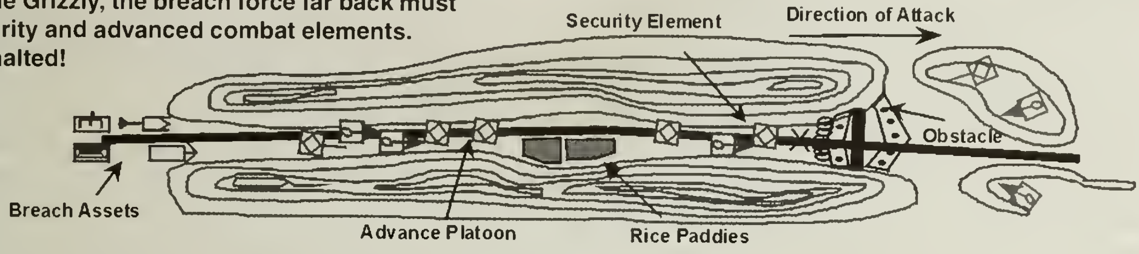
Today's techniques for defeating complex obstacles consisting of antipersonnel wire, minefields, and antitank ditches require a very complex operation involving several types of specialized equipment that do not offer the mobility and survivability of the Grizzly—and none possesses the flexibility of equipment to defeat all of these types of obstacles. Since multiple equipment types must be used *while in the middle of a minefield*, the operation simply cannot be accomplished as rapidly as the tempo of modern battle requires.

Exactly what may be involved in defeating complex obstacles today depends on the scope and configuration of the obstacle—thereby complicating task organization and mandating the requirement for lengthy reconnaissance and rehearsals. Essentially, five types of equipment are or can be involved in the operation, depending on the scope of the obstacle, and often result in the maneuver commander having to unnecessarily sacrifice equipment or personnel that would otherwise be used to provide combat power. These include—

- Dismounted engineer soldiers (called sappers) to deal with wire entanglements and provide mine detection/clearing.
- Multiple M58 mine-clearing-line-charge (MICLIC) shots to detonate pressure mines over the depth of the minefields.
- M1 tanks equipped with BCS components for clearing/detonating residual mines and "proofing" the lane.
- An M9 armored combat earthmover (ACE) or bulldozers to destroy/move earth cribs and concrete obstructions or fill in antitank ditches.

Operational Advantages of the Grizzly

Without the Grizzly, the breach force far back must pass security and advanced combat elements. Attack is halted!

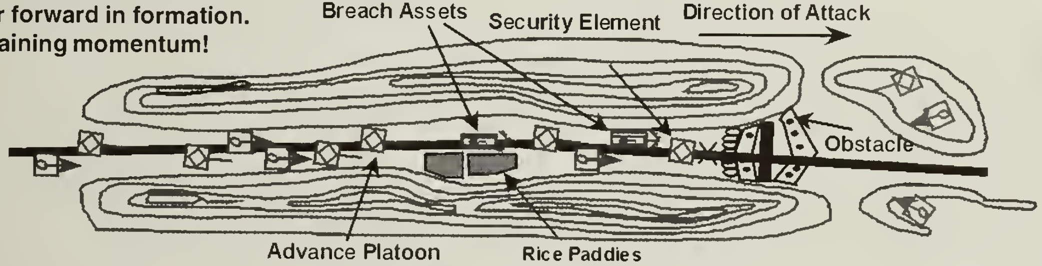


The Grizzly preserves tactical options and flexibility for the commander. Here, in constrained terrain such as Korea, where parallel ridges are common and almost all arable areas are under cultivation with crop areas such as rice paddies, roadways are extremely narrow and even tanks can get bogged down if they leave the road surfaces.

These areas are ideal locations for the enemy to construct complex obstacles. Since the terrain is constrained, "bottleneck" zones are easy to find where minimal assets are required to emplace obstacles that would pose extremely difficult tactical problems in continuing the tempo of the advance. As shown above, the attack is essentially stopped while the necessary engineer assets have to pass the length of both the advance platoon and the security element before they can get to the obstacle. These assets do not travel far forward because of their vulnerability and lack of mobility.

The scene below shows the advantage of the Grizzly. It can be right with the security element as the unit approaches this terrain. Upon encountering the obstacle, the Grizzly can immediately deploy to defeat the obstacle, preserving attack momentum.

With the Grizzly, the breach force may move much farther forward in formation. Attack while maintaining momentum!



- A heavy assault bridge (HAB), such as a Wolverine, or an armored vehicle-launched bridge (AVLB), for spanning the antitank ditch or the wire entanglements.

This does not include the manuever forces that must suppress enemy overwatch elements while these vulnerable systems negotiate their very trying missions.

All of this equipment must be collected and synchronized, which requires considerable time for reconnaissance, planning, assembly of equipment/personnel, rehearsals, etc., often taking hours, days, or even weeks to complete. The actual conduct of a breach doctrinally follows some variation of suppressing the enemy force that is overwatching the obstacle and obscuring the view, securing the obstacle and reducing it with lanes through it, and securing the far side. If the complex obstacle begins with antipersonnel wire or barriers to a minefield, dismounted soldiers or sappers deploying bangalore torpedoes, detonation cord, or other means are currently employed and may include using an AVLB to clear or bridge them. Their efforts may be complicated by the presence of antipersonnel mines or explosive antihandling devices in the wire.

Once a lane in the wire is created, a series of MICLICs, each weighing more than 1,500 pounds, with the telltale signature of a rocket propellant in-flight, must be fired into the minefield. The number depends on the linear depth of the minefield. After each MICLIC is fired, a lane must be proofed by other means before it can be assured as safe. The current practice requires that tanks equipped with mine plows or rollers be dedicated to clearing a track-width lane (one small lane for the left and one for the right track) and defeating residual mines missed by the MICLIC detonations. These tanks, while performing this mission, are necessarily lost to the maneuver commander for their primary combat role—and sometimes until after they are repaired from the damage sustained during a breaching mission.

The presence of the antitank ditch adds serious complications since neither the BCS-equipped tanks nor the MICLICs are effective against this obstacle. This means that this equipment must be *backed out of the lane* and the M9 ACE, AVLB, or bulldozer brought forward. Operation of these vehicles can be greatly complicated by mines in the vicinity of the ditch. If one of these vehicles is disabled, it becomes itself a formidable obstacle to the breach, which may then require another armored vehicle or recovery vehicle to move in and extract or move it from the lane. Once past the ditch, the presence of more mines may force these earthmoving vehicles to carefully *back out of the lane* so that MICLICs and BCS-equipped tanks can again be employed past the ditch. Since the lane must be kept clear so the vehicles can move forward as needed, few—if any—exploitation forces can move into the breach until it is entirely clear. This means that the vulnerability to counterattack action by the enemy is very high because of his almost certain knowledge of where the attack will occur.

As one easily senses from the previous description, this "parade" of various types of specialized equipment, described by some as "an orchestrated ballet of farm implements," entails enormous risk to the mission. The failure of one system may nullify or even block the remaining effort. Meanwhile, the overall operation or even the entire campaign may fail. The whole operation— under easily imaginable combat conditions of fire, smoke, and the dangers of hidden mines—may simply require too much sheer guts on the part of the soldiers earmarked to accomplish it, even under the most benign circumstances where only pressure mines are the threat. The risk of failure heightens tremendously when non-pressure-sensitive and/or smart mines exist in the mix, which can frustrate the operation and cause many casualties in the breach force. It is readily apparent that such an operation cannot be conducted without losing momentum, even by the most modern mechanized forces.

A Utility Knife for Obstacles

The Combined Arms and Support Task Force Evaluation Model (CASTFOREM) modeling and analysis have amply demonstrated the success of the units equipped with the Grizzly. The time that forces are exposed to enemy fire during a normal breach is reduced by nearly two-thirds. The probability that a task-force two-lane breach will be successful is increased nearly six-fold. The loss-exchange ratio is half that without the Grizzly in the force. The use of the Grizzly preserves combat power while decreasing friendly losses, reducing exposure of soldiers to enemy fire and actually presenting a bonus to the commander because he now has all of his tanks available for combat—not damaged by mines in the breach or simply unavailable due to diversion to the breaching role. In addition, all the other engineer equipment mentioned—such as the bulldozers, M9 ACEs, and HABs—is now available for its primary mission functions.

A point worth mentioning with regard to the Army's Transformation is that variants of our current inventory of Abrams tanks and Bradley fighting vehicles will be used by U.S. Army soldiers for 30 years or more from today. The Army's Transformation, as we all know, has three parallel axes (Legacy, Objective, and Interim Forces), and the Grizzly system is part of the Legacy Force. By many estimates, the Legacy Force systems will remain in the Army's inventory until 2032, which means that the requirement for the Grizzly to conduct complex-obstacle breaches will be valid for many years to come. Additionally, as long as the Army's Counterattack Force packs the punch of today's armored equipment, the maneuver commander will need the Grizzly to ensure that he can maintain dominant maneuver on the battlefield.

What If We Had a Grizzly?

We've mentioned a few historical instances where obstacles have been decisive or played a major role in the outcome. Some are worth conjecture from a what-if standpoint. For example, at Verdun, the Germans expended millions of shells and suffered hundreds of thousands of casualties but could not break through. Even without extensive minefields in that campaign, a protected engineer system like the Grizzly could have unhinged the French. The first tank offensive by the British at Cambrai bogged down because the primitive tanks couldn't negotiate the terrain in-depth. A Grizzly-like system could have had a role there. Rommel's North African campaign frequently featured encounters with complex obstacles in-depth. Rommel seemed to always outflank them in the featureless desert—that is until the Quattara Depression anchored the Commonwealth left flank at El Alamein. A Grizzly system may have provided other options to the "Desert Fox." The Germans at Kursk, even with tanks that greatly outclassed the Russians, were decisively defeated when the panzers could not negotiate the extensive complex obstacles employed in-depth by Marshal Zhukov's armies. Admittedly, putting the Grizzly into these historical instances is a stretch, but what about a more recent example such as the Persian Gulf War? The inset on page 41 depicts the actual experience of the U.S. Marines in breaching an Iraqi obstacle zone.

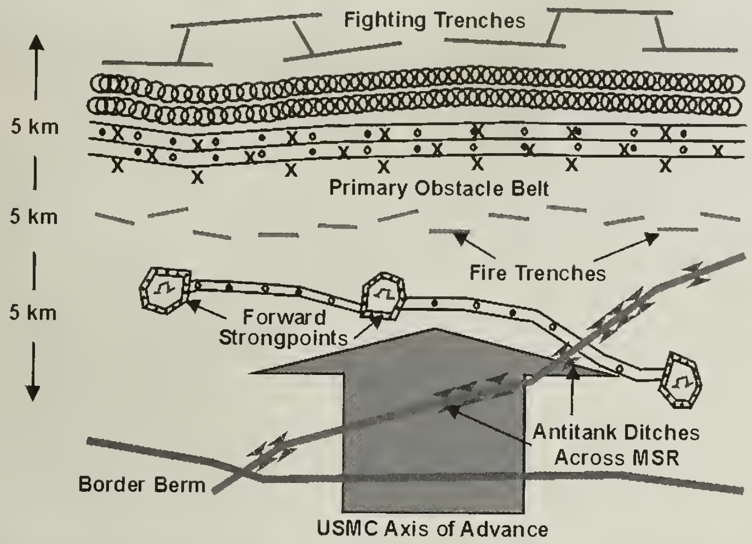
Where Is the Grizzly Now?

The Grizzly is well on the path toward making the concept of conducting a breach without losing momentum a reality. Already fully engaged in the Engineering and Manufacturing Development phase of the acquisition life cycle, prototype vehicles have been produced by the prime contractor, United Defense Limited Partnership, and have demonstrated solutions to many of the technical challenges presented by the Grizzly's challenging mission. The terrain sensors and onboard blade controllers have been employed with survivable mine-plow-blade components to remove seeded mines to a depth of up to 12 inches at speeds capable of meeting established standards. Minefield breaches where the blade depth was manually controlled have also been successfully demonstrated with the Grizzly prototypes. Clearly, the progress and performance of the system to date are impressive and unprecedented.

The power-driven-arm technology is an adaptation of commercially available equipment. While in and of itself not a challenge, closed-hatch vision throughout its full range of motion and anticollision software development add to the complexity of its integration. This requires the use of external cameras and the electronics required to bring the video to the operator to permit day, night, and all-weather operations.

Additional effort is needed to ensure that the system progresses beyond the prototype stage and meets standards in government Live-Fire Test and Evaluation, Initial-Operational Testing, and Production-Verification Testing. The opportunity to bring this critical technology to the force in the field, however, is fleeting. The team is now assembled to solve any residual challenges that need to be faced to get this system to the field. The potential to meet the challenge will inevitably dwindle and

Iraqi Defensive Obstacle Belts in Front of the 2d U.S. Marine Division



In the Persian Gulf War, elements of the 2d U.S. Marine Division were tasked with penetrating Iraqi defensive positions arrayed in-depth as depicted in the diagram. The complex obstacles deployed by the Iraqis included antitank and antipersonnel minefields, berms, wire and point obstacles, antitank ditches astride the existing all-weather road, and reinforcing trenches and strongpoints for defenders of the lanes through the obstacles.

The Marines conducting the operation had several weeks to prepare for the breach mission. Each obstacle was treated as a separate simple obstacle with the appropriate equipment brought forward to deal with obstacles individually. Even though the breach was unopposed due to the previous withdrawal of Iraqi forces, each simple obstacle took from 30 minutes to 3 hours to defeat. These obstacles included several dummy minefields. Dismounted Marines proofed the lanes. The time it took for each task force to clear two lanes through the belt was 2.5 to 9.5 hours. It took 1 to 2 days for friendly elements to pass through to the other side of the obstacle.

Track-width mine-plow tanks were employed, and 9 of 11 vehicles that hit mines during the operation suffered mobility kills. These tanks had to be repaired before they could rejoin their units in the advance. Of the 45 MICLICs used, 20 failed to remove all the mines, and supplementary action was necessary to clear or proof the lanes.

may disappear unless the requisite fiscal support for this critical system is forthcoming. It would be a tragedy for the Army to make a great investment in a revolutionary new concept of lighter and harder-hitting combat systems but still be reduced to the pace of the crawling soldier in the face of a mundane complex obstacle. Unfortunately, this condition is a reality today unless the Grizzly achieves its potential and allows the Army to fully exercise its dominant maneuver characteristics.

Summary

The Grizzly program provides a unique and heretofore nonexistent capability to the force—the ability to defeat complex obstacles, from the march, while maintaining the pace and momentum of the attack. When successful, the benefits provide a synergistic influence to simultaneous combat objectives—dominating maneuver and winning the information war. Its success in its intended role will substantiate the Grizzly's combat importance to the maneuver commander and its operational benefit. It is a vital system for controlling key dimensions of the future battlefield: speed, space, and time. The Grizzly's technology also has the potential to enhance future Objective Force equipment performance. The program-management office continues to work to bring the system to fruition as early and as economically as possible but needs support from all those who are knowledgeable and interested in ground-mobility issues. Let us not be left with the agonizing question to answer, "If not the Grizzly, then what?"

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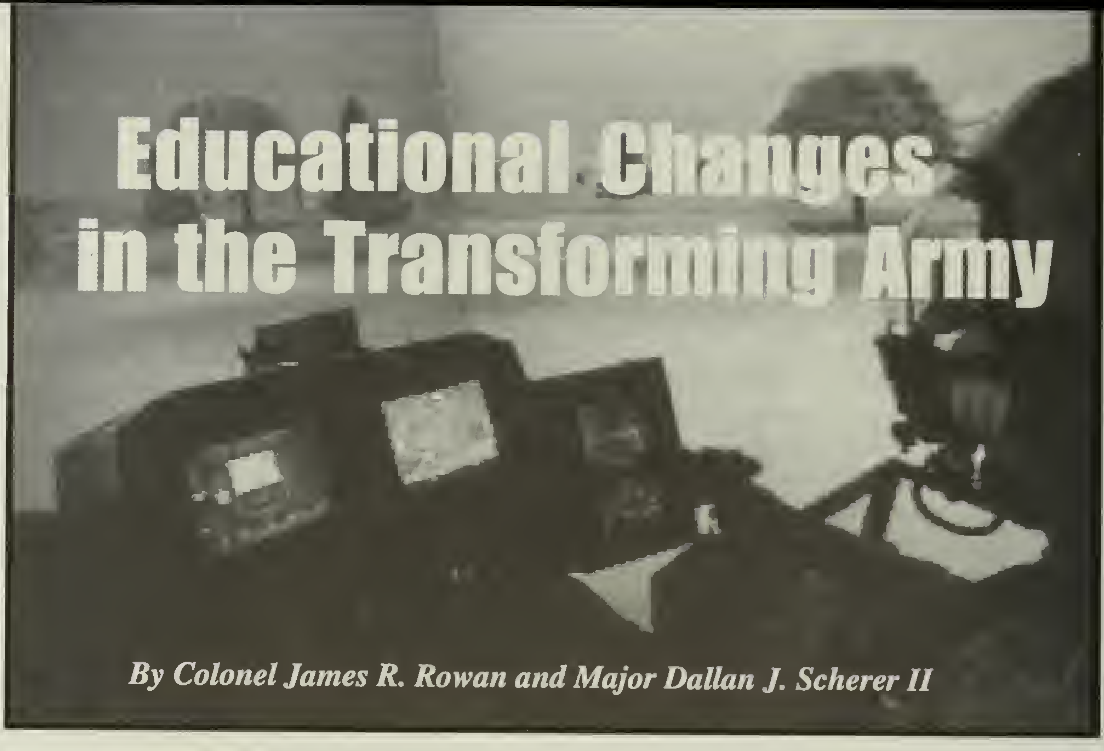
Educational Changes in the Transforming Army



By Colonel James R. Rowan and Major Dallan J. Scherer II

> ***The Army Vision:*** *We are about leadership; it is our stock in trade, and it is what makes us different. We take soldiers who enter the force and grow them into leaders for the next generation of soldiers. We will continue to develop those leaders through study in the institutional schoolhouse, through field experiences gained in operational assignments, and through personal study and professional readings.*
>
> *General Eric K. Shinseki*
> *Chief of Staff of the Army*

Army Transformation has been well underway for more than a year now. Most people with any interest in the Army are very aware of the three-axes model depicting the Legacy Force, the Interim Force, and the Objective Force. The Interim Brigade Combat Team (IBCT) at Fort Lewis, Washington; the Interim Armored Vehicle; and the Interim Division (IDIV) are also recent headline news. Less well known are the changes that TRADOC and the proponent schools are making in military training and education systems and their impact on soldiers of the current and future Army. The leader-development operational and organizational document covers all proposed leadership educational transformations (such as the Noncommissioned Officer Education System and the Warrant Officer Education System).

The first part of this article highlights some of the current training challenges for lieutenants, captains, and majors and then focuses on the transformation of the Officer Education System (OES) and the rapid changes occurring within TRADOC.

Current Officer Education System

The current OES has served the Army well for many years. Very few large organizations in the world are able to devote the time and resources the Army does to ensure that its leaders are developed and prepared for increased responsibility. General Lesley J. McNair, often referred to as the "educator of the Army" and the "trainer of the Army," had an enormous impact on our current education model for training officers, NCOs, and soldiers. The McNair Model, developed for World War II mobilization, produced large numbers of soldiers and leaders to meet requirements generated by a 100-division Army (see endnote, page 48). While this training strategy has served our nation well through the end of the Cold War, where World War III European scenarios required large numbers of personnel replacements, it is simply not efficient enough to meet the needs of today's force. With a smaller, busier, and resource-constrained Army, a new training paradigm is being realized.

As we progress into the twenty-first century, the United States finds itself without peer competitors. The battlefields of this century are not likely to be total wars but small-scale contingency operations at various flash points around the world. The hostilities of the future may be more like our experiences in Bosnia or Kosovo and less like our involvement in the Gulf War.

Over the last two decades, the Army has continually reduced its manpower, but missions and deployments have steadily increased. In the past, we had the luxury of following an "alert, train, deploy" model for most of our major deployments. But the transformed Army—in order to meet General Shinseki's aggressive timelines for brigades and divisions to be operational in theater—must now move to a "train, alert, deploy" model. This places much tougher requirements on training institutions and operational units throughout the Army.

The current Army officer educational model is based on the three pillars shown in Figure 1: institutional training, self-development, and operational assignments.

Institutional Training

The institutional piece of officer training is well established. TRADOC has set precommissioning requirements that are accomplished through the Reserve Officer Training Corps, the United States Military Academy, or the Officer Candidate School. After being commissioned, officers attend the basic course of their branch. While the lengths of branch courses vary considerably, their common goal is to train second lieutenants on the leadership and technical skills they must possess to meet the challenges associated with their first unit assignment. It's important to note that lieutenants are not taught every critical task while attending the officer basic course. The Engineer Officer Basic Course (EOBC), for example, only covers about 65 percent of the critical tasks for junior engineer officers. Accordingly, field commanders must build upon the lieutenants' newly acquired skills and train those tasks not covered during their initial officer training, thereby ensuring that these officers are competitive for promotion and increased responsibility.

After their promotion to captain, officers attend the Captain's Career Course (CCC), which is usually at their branch school. This course is taught primarily in a small-group environment and is one of the real highlights of an officer's education. Officers who attend the Engineer Captain's Career Course (ECCC) bring a wide variety of experience and knowledge from their previous assignments and are trained by a carefully selected team of small-group leaders. When they complete training at Fort Leonard Wood, Missouri, most captains attend the Combined Arms and Services Staff School (CAS3) at Fort Leavenworth, Kansas. Additionally, many officers participate in the cooperative graduate-degree program through the University of Missouri at Rolla (UMR) or the University of Missouri at St Louis (UMSL). After 24 to 33 weeks, these officers are ready to serve on a brigade or battalion staff and command company-sized units. Clearly there is a disconnect here since many of these officers have already been primary staff officers at a battalion or brigade and, for a number of reasons, a key part of their training may be coming too late.

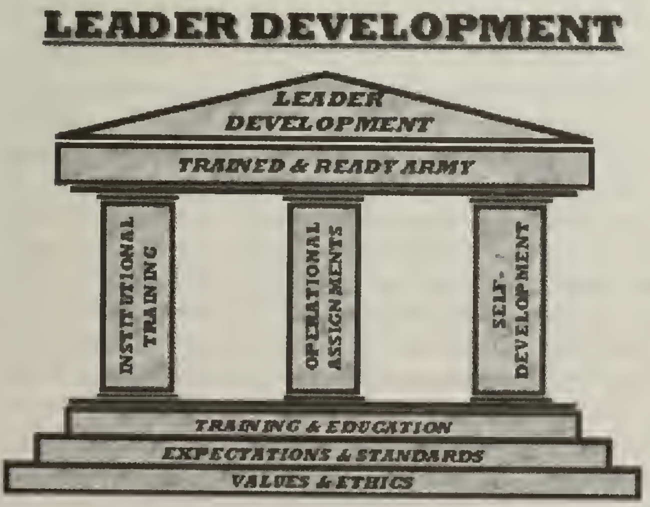


Figure 1

Small-group instruction and hands-on exercises are fundamental to the ECCC.

Institutional training for majors is still at the Command and General Staff College (CGSC) at Fort Leavenworth. One of the key provisions of Officer Personnel Management System (OPMS) XXI is the transition to a universal military education level (MEL)-4 qualification, but this still has not been implemented. After promotion to major, a Department of the Army board looks twice at officers' records to determine which of them will attend resident CGSC training. However, about 50 percent of each year group still completes MEL-4 through nonresident studies. Consequently, the perception in the force is that these officers have been taken out of the running for key leadership positions at the major and lieutenant colonel ranks. Whether we agree or disagree with it, the reality is that this is our current institutional OES.

Self-Development

The existing self-development phase of officer education is arguably the weak link in the chain. While a number of officers are actively engaged in correspondence courses, developmental-reading programs, and other individual professional initiatives, success is strictly a function of each officer's personal desire to learn and grow. Most units have an established professional-development program, but success is very localized and generally inadequate across the Army or Engineer Regiment. These shortcomings are a result of various causes and effects but are generally related to operating tempo (OPTEMPO) and officer shortages.

Operational Assignments

It would seem that the current high OPTEMPO and shortage of officers in several grades would provide a tremendous opportunity for officers to benefit from operational assignments. But in actuality, this may have just the opposite effect. With units that are extremely busy and trying to juggle many glass balls, there is less opportunity for senior officers to train, develop, and mentor junior officers. Ample evidence reveals that company-grade officers perceive that they are not getting enough interaction with their superiors.

During the past few years, most units have had more lieutenants assigned than their modified table of organization and equipment (MTOE) or table of distribution and allowances (TDA) allows. The obvious effect is that a generation of officers is being deprived of valuable platoon-leader experience that everyone recognizes as critical to junior-officer development. Additionally, more lieutenants fill validated captain's positions; these officers struggle to accomplish assigned tasks in which they have no formal training or experience. Lieutenants who are cast into a captain's position may not have had the opportunity to see "what right looks like." Unless their leaders (who may be in the same situation) can ensure that they are working and training to standard, the education gained through operational assignments may be built on a more fragile foundation than it was just a few years ago.

Proposed Changes

One proposal is to review the captain's critical task list, identify those skills that now apply to lieutenants, and shift/train these skills during the officer's initial training. Other proposed changes include the following:

Basic Officer Leader's Course

One of the most sweeping changes—and one that will occur quickly—is the establishment of the Basic Officer Leader's Course (BOLC). All second lieutenants will attend this course after they are commissioned but before they attend their basic branch course. The BOLC, which focuses on small-unit leadership in a field environment, is taught at Fort Benning, Georgia. The proposed course design is based on the U.S. Marine Corps model and establishes a common standard for all junior officers. Training will encourage junior officers to gain the identity of an "Army officer" rather than an identity of "engineer (or infantry, or armor, or finance…) officer," reviving the warrior ethos. Current branch basic courses are not inadequate nor are they failing at their task; but rather the clear goal for BOLC is simply "better is better."

The Infantry School has already conducted a BOLC pilot class composed of all infantry officers. A second all-infantry pilot class was scheduled for later in FY01. However, the class has since been revamped to include 40 noninfantry officers. Three of the officers are engineers who will attend the EOBC after completing the BOLC. Full-up implementation of the course for all officers is scheduled to begin in FY03. The length of the BOLC is still being determined, but it is expected to be between 6 and 8 weeks long. The critical aspect is that officer initial-entry training (BOLC plus the branch course) will not exceed 19 weeks and 4 days. This cap is necessary to decrease the population in the OES Trainees, Transients, Holdees, and Students (TTHS) account. The current account records 65,000 man-days per year, which is clearly too high a percentage of our force.

The goal of BOLC is to encourage lieutenants to gain the identity of an "Army officer" and revive the warrior ethos.

Engineer Officer Basic Course

The EOBC will also undergo major changes with the implementation of the BOLC. The proposed model calls for proponents to provide requisite technical and tactical training for lieutenants. A portion of the current TRADOC common-core subjects will be trained at Fort Benning; therefore, the focus of branch schools is on branch-specific critical tasks. As a result, proponents will use whatever time remains to complete these requirements. This is a major concern for the Corps of Engineers, demanding tough calls to determine what is trained during the EOBC. Our goal is to continue to train officers for the diverse engineer missions they will encounter, such as combat engineering, bridging, construction, topography, and light-engineer operations. Based on the time available, there will be some threshold where we can provide only the specific training our junior officers will require in their initial assignments. This threshold is still undetermined and is a primary concern as we make this major transition. The Engineer School has a breakout session scheduled during ENFORCE 2001 to address the EOBC restructuring issues associated with implementation of the BOLC.

Captain's Career Course

Significant changes for training captains is also under review with implementation expected in the near future. The current ECCC model is well known. Upon promotion to captain, officers submit a DA Form 4187, *Personnel Action*, requesting attendance. Training prerequisites and academic requirements required to attend training are minimal. The course consists of an 18-week program at Fort Leonard Wood, followed by 6 weeks of TDY for CAS3 at Fort Leavenworth. Over the past FY, in excess of 50 percent of officers then return to Fort Leonard Wood as students and complete their master's through UMR or UMSL. As we transition, these graduate programs remain essential and must be continued; they fill a critical need for our branch by providing an opportunity for our officers to complete a master's during the career course.

Another essential element of the CCC that we must retain is small-group instruction, which uses small-group processes, methods, and techniques to stimulate learning and promote group dynamics. This method of instruction places the responsibility of learning on individuals through participation and interaction. Officers from various backgrounds, cultures, and experiences are grouped into small teams led by a select group of branch-qualified company-grade officers that serve as role models, coaches, and mentors. Distance learning or large-group lecture settings cannot duplicate the obvious advantages provided by this small-group environment.

Proposed resident school curricula will increasingly focus on teaching the nature of war as opposed to only the scientific conduct of war. The modern operational environment demands leaders who can reason and make decisions in new and unexpected situations.

The curricula will teach leaders *how* to think and not *what* to think. TRADOC initiatives direct that future training focus on technology to leverage information in a variety of ways that increase the Army's warfighting capability. The training vision involves increasing training opportunities, optimizing training availability, and incorporating multiechelon events that prepare leaders to meet the demands and challenges of tomorrow's battlefield. Our units require adaptive, flexible, intelligent leaders who are comfortable and competent in potential future complex operations. Training must prepare our leaders to lead units to fight and win in combat across the entire spectrum of conflict. This requires that all leaders understand and enforce high standards of combat readiness through realistic, multi-echeloned, combined-arms training that challenges and develops individuals, leaders, crews, and units. The future career course will focus on this and will be designed around FM 22-100, *Army Leadership*.

Combined Arms Battle School

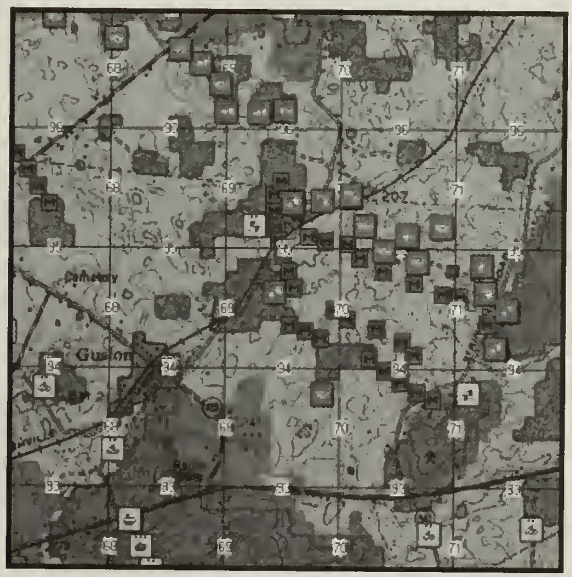
The Armor School at Fort Knox, Kentucky, is charged with designing, overseeing, and developing the future Advanced Officer Leader/Battle Captain Course (AOL/BCC). The school is preparing to implement a pilot course for 4th quarter FY01 and has dubbed it the Combined Arms Battle School (CABS).

The continuing reduction in resources dictates an education system that eliminates redundancy and focuses leader-development efforts where they can best be accomplished. An example of one of the challenges is to evaluate the CAS3 program of instruction (POI). The goal is to identify training redundancies, identify and embed pertinent critical tasks into the future officer AOL/BCC, and determine what tasks can be eliminated or transitioned to other leadership courses. Additionally, planners must not exceed the current CCC length of 24 weeks when designing the AOL/BCC. The proposed CABS is targeting a 20- to 24- week timeframe and will include critical tasks identified from the current 24-week CCC model (combined officer advanced course (OAC) and CAS3). Overall savings can be realized by eliminating the need to send officers TDY to CAS3 and hopefully train all OAC and CAS3 critical tasks in less time.

The CABS will be a battle-based, combined-arms leadership school. Small groups should consist of about 14 students (3 armor; 3 infantry; 1 engineer; 2 field artillery; 1 aviation; 1 air defense, military intelligence, or signal; 1 Marine; and 2 or 3 international officers). The proposed instructor base will consist of 2 armor, 2 infantry, 1 field-artillery, 1 engineer, and 1 aviation officer. Additional support will be required from air-defense, military-intelligence, and signal instructors.

The purpose of the AOL/BCC is to train combined-arms officers who are self-confident, adaptive commanders and battle-staff officers who can lead companies and staff teams who can solve complex problems across the entire spectrum of conflicts. These officers will be capable of performing in both legacy (modernizing) and interim combat units. The design increases leadership opportunities through constructive, virtual, and live simulations and maximizes the integration of the multiechelon, multigrade, battle-focused leadership experiences encompassing all nine leader actions.

Constructive Simulation. Constructive Joint Army/Navy Uniform Simulation (JANUS) and Tactical Operations (TACOPS) Simulation training is planned for the CABS. Using computer simulations, student leaders can plan, prepare, and execute battles. These exercises are conducted in a small-group environment where combined-arms officers test their abilities to plan and execute combat operations. TACOPS is an off-the-shelf (with enhancements), PC-based computer simulation that enables students to load and fight their tactical plans. Using a standard laptop or desktop computer, student officers can fight one another (or the computer) and "validate" their plans through execution. Normally, when training troop-leading procedures or the military decision-making process, training stops after a plan is published. By taking full advantage of of TACOPS, small-group leaders can provide a training environment that enhances the orders process from receipt of a mission through its execution. This flexibility increases the ability of student officers to fight a plan through execution



TACOPS simulation training

numerous times using various environments. The flexibility that TACOPS brings to the small-group environment has huge advantages over the one or two opportunities most officers currently experience using the limited JANUS facilities. TACOPS is quite similar to JANUS and even allows playback or reexecution of the fight to reinforce discovery learning and thereby enhance small-group-leader-facilitated after-action reviews.

Virtual Simulation. Virtual simulation is incorporated using systems such as the Close Combat Tactical Trainer (CCTT) and Simulation Network (SIMNET). These combat-vehicle simulators allow leaders to plan, prepare, and execute company-level missions in a multiechelоned virtual environment.

Live Simulation. Live simulation training provides battle-focused leadership experiences using multiple-command situational-training exercises that challenge leaders under the most realistic battlefield conditions possible.

Distributive Learning. Individual training is increasing by using advanced technology outside of the educational environment. Future preresident/postresident courses will provide soldiers the flexibility to receive critical, mission-essential, and professional-development instruction via a mix of distributed-learning instruction. Presentation mediums can be resident or nonresident—Classroom XXI-based, Web-based, CD-based, a mix, and/or traditional-based. These packaged courses can be tailored to individuals to enhance their knowledge base and/or prepare them for a specific assignment.

Because approximately 28 engineer officers a year attend the CABS, the Engineer School has been involved in the design of the course from the start. Future branch AOL/BCCs will not be identical in design or execution to the CABS, but the overall intensity and training environment will be very similar. As we continue to advance in technology, we must find a way to leverage it to our advantage without taking away the vital interactive learning processes gained through personal interaction. By analyzing and carefully studying pilot programs such as CABS, future training technologies and initiatives, and the continued efforts of training development, a balance of the right skills—taught at the right time and place—can be realized. Already, we can train soldiers while they are still in their units or even while they are deployed. The result enhances soldier/leader educational opportunities and reduces the overall time soldiers are away from the force and, more importantly, their families. In essence, we can transform current classrooms into a world-class campus without walls.

Future Engineer AOL/BCC

As for the future of the engineer officer's AOL/BCC, one concept that is under consideration is shown in Figure 2. This planning draft is for a 22- to 24-week course that eliminates redundancy with the CAS3 POI and includes additional future critical tasks. Additional time is allocated to digital training and integration of the Army Battle Command System (ABCS). The proposed course will also maximize the use of constructive, virtual, and live simulations to incorporate various force

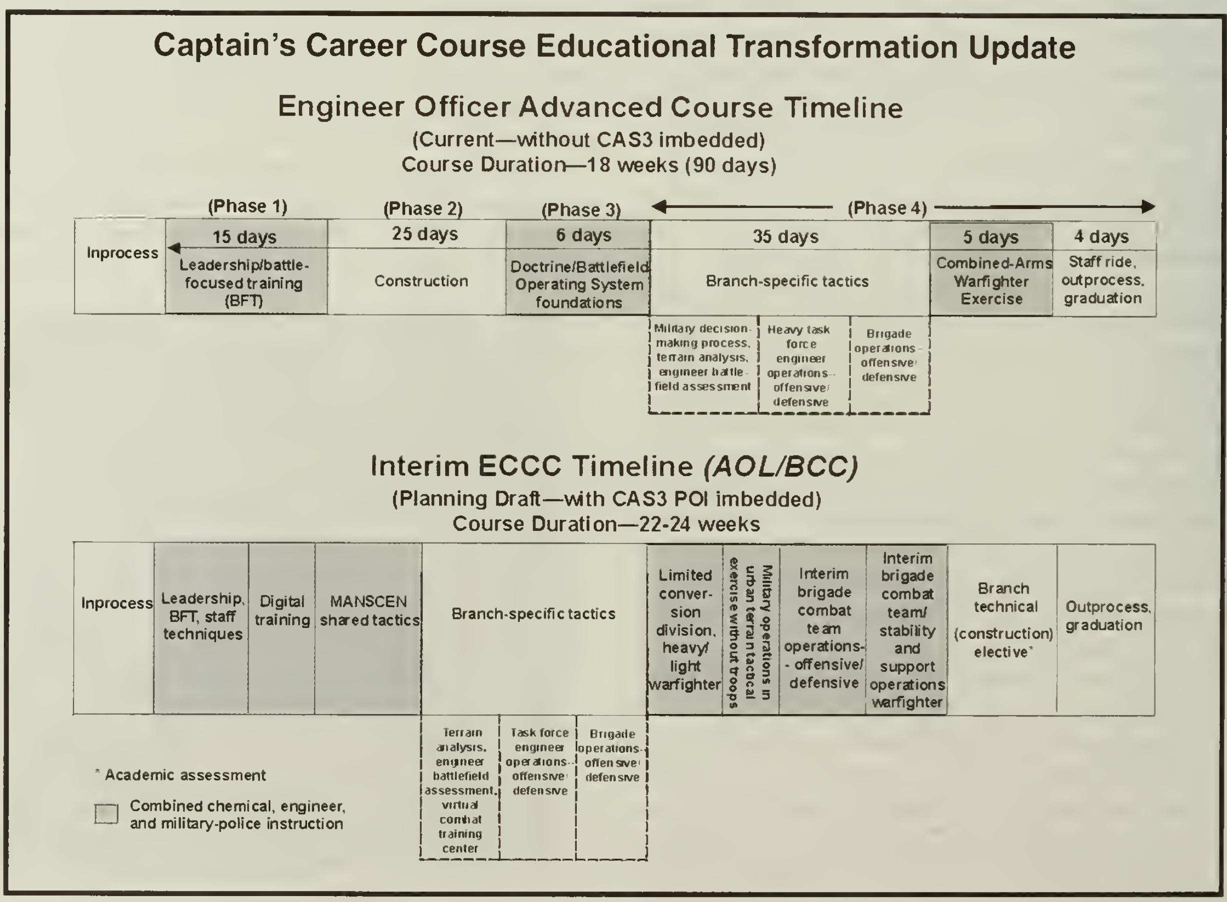

Captain's Career Course Educational Transformation Update
Engineer Officer Advanced Course Timeline
(Current—without CAS3 imbedded)
Course Duration—18 weeks (90 days)
(Phase 1)
(Phase 2)
(Phase 3)
(Phase 4)
Inprocess
15 days
Leadership/battle-focused training (BFT)
25 days
Construction
6 days
Doctrine/Battlefield Operating System foundations
35 days
Branch-specific tactics
5 days
Combined-Arms Warfighter Exercise
4 days
Staff ride, outprocess, graduation
Military decision-making process, terrain analysis, engineer battlefield assessment
Heavy task force engineer operations--offensive/defensive
Brigade operations-offensive/defensive
Interim ECCC Timeline (AOL/BCC)
(Planning Draft—with CAS3 POI imbedded)
Course Duration—22-24 weeks
Inprocess
Leadership, BFT, staff techniques
Digital training
MANSCEN shared tactics
Branch-specific tactics
Limited conversion division, heavy/light warfighter
Military operations in urban terrain tactical exercise without troops
Interim brigade combat team operations--offensive/defensive
Interim brigade combat team/stability and support operations warfighter
Branch technical (construction) elective*
Outprocess, graduation
Terrain analysis, engineer battlefield assessment, virtual combat training center
Task force engineer operations--offensive/defensive
Brigade operations-offensive/defensive
* Academic assessment
Combined chemical, engineer, and military-police instruction

Figure 2

structures and environments. Some of the current training will transition to distributive learning, but careful analysis and study is ongoing to ensure that the right critical skills remain in the resident phase.

Future proposed engineer AOL/BCC models will also require that officers show proficiency on specific critical gate tasks before being allowed to enroll and subsequently graduate from the advanced course. Every effort to maintain the post-graduate schooling opportunities (at UMR and UMSL) will be expended to ensure that future leaders understand that continuing education remains the highest priority. Expect the future advanced engineer leaders' training to maximize the use of technology and constructive, virtual, and live simulations to maximize performance-oriented, experience-based training at all levels and across the entire spectrum of operations.

Future Command and General Staff College

The transformation of training for majors primarily involves the implementation of OPMS XXI initiatives. A universal form of MEL-4 will replace the current model of approximately half of each year group being selected to attend the resident CGSC. This is an overdue initiative that needs to be set in place as quickly as possible. The current stratification of year groups into the resident and nonresident MEL-4 is dividing year groups immediately after officers are selected for promotion to major. The spin-off is causing stress to officer career development at all levels. Universal MEL-4 must be incorporated and the appropriate training be determined by the officer's career field as quickly as possible. Many people recognize this as critical, but it does not have the same urgency and emphasis that some of the other officer-education transformation initiatives are receiving.

Concerns

There is tremendous momentum in TRADOC to transform the OES. There is great merit in most of these proposals. But there are also several areas of concern that could be easily overlooked as these courses are planned, developed, and implemented through pilot programs.

The first concern involves a major change in our culture. Schools are, by design, moving toward a shorter, more intense, and more demanding atmosphere. For years, the institutional school environment has provided both an educational opportunity and an opportunity for students and their families to enjoy the lower OPTEMPO, regular hours, and relaxed environment associated with schools. These embedded benefits are currently paid for through TDY costs and the Army's TTHS account. But if we move to a system where our career schools are "academic Ranger schools," we risk even greater junior-officer-retention problems in the name of efficiency and cost effectiveness.

Another potential risk is the goal of eliminating all redundant training. This is another concept that briefs well and is appealing to leaders who measure success in terms of only cost savings or course reductions. An excellent example may be our attempt to embed CAS3 into the CCC without increasing the course length. Practical exercises that require students to progress through stages of the military decision-making process are included in both the CCC and CAS3. Course subjects like the military decision-making process clearly require repetitive training for students to gain insight and achieve a higher degree of understanding. The tough call between wasteful and redundant training versus the benefit of reinforced training cannot be assumed away as we press forward with transformation. As CAS3 is embedded into the CCC, we also accept a reduction in the experience and grade of the trainer. Originally, and almost exclusively, former battalion commanders trained CAS3 students. It is still taught by experienced field-grade officers, so even if the tasks are carried over to a different course, we will lose some of the wisdom and experience as the instructors change from lieutenant colonels to captains. It is impossible to directly measure how much will be lost due to the structure change.

Another concern, and one of the key facets of current proposals, is the implementation of rigorous entrance requirements. Operational units are busy. Adding more requirements to officers while they are fully engaged is a tempting target, but the dangerous implications of this are obvious. Even if officers and their units are able to make the time for distance learning or Web-based courses to be completed, there is little argument that these courses are generally not as rewarding or beneficial as classes taught under the traditional design. We will make this transition, but care must be exercised to ensure that we convert the correct number and type of courses to distance learning. Some training, leadership and command-climate classes, for example, require the interaction of a diverse group to really gain the insights necessary for a student to benefit.

Challenges

Today's military missions and operational and strategic policies dictate that we produce skilled, self-confident, adaptive leaders who can win on any battlefield across the full spectrum of conflict. Focused, tailored training is key, whether it is preresident, resident, or postresident training. Providing expertly packaged, more frequent training for shorter periods allows the mind to better absorb and understand concepts and, overall, increase retention. Incorporating the key learning elements—visual, auditory, and kinesthetic (hands-on practical exercises)—into training improves overall learning as well. This can be accomplished best by providing the right combination of distributive-learning multimedia technology and capitalizing on combat-training-center and unit training. Our challenge will be to wisely use the limited resources we have to develop the most effective and innovative training feasible. We must incorporate the fundamental learning concepts while keeping the concerns presented on the forefront. The ongoing analysis and design of our distributive-learning plan, and leveraging the use of technology to improve training, are therefore essential to successfully transform our educational system and ensure that we maintain the most realistic and challenging training possible.

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Major Scherer is a small-group leader for the Engineer Officer Advanced Course at the Engineer School. A former commander of A/94th Engineer Combat Battalion (Heavy) in Germany, he also served as an engineer observer/controller at the Combat Maneuver Training Center and with the 130th Engineer Brigade and the 4th Engineer Battalion. Major Scherer holds a bachelor's in automotive technology and management from Western Michigan University.

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Endnote:

As commandant of the Command and General Staff College 1919-21, Colonel/Brigadier General (temporary) McNair initiated changes that prepared the college's graduates to meet the upcoming challenges of World War II. In 1939, 18 years after serving as an instructor at the General Service School at Fort Leavenworth, Kansas—during which time he graduated from the Army School of the Line—he returned to Fort Leavenworth to reform and update the instruction. In 1942, as a lieutenant general (temporary), he was designated Commanding General, Army Ground Forces. Once he was satisfied that the Army could operate in large bodies, he concentrated on revising training to simulate the conditions that the Army was facing in North Africa. General McNair, known as "educator of the Army" and trainer of some three million troops, was about to take command of Allied ground forces in Europe under Eisenhower, when he was killed in combat in Normandy on 25 July 1944. After his death, it was said of Lieutenant General McNair that he did more than train men; he realized that no army could be fully effective unless it was properly organized, correctly equipped, adequately led, and completely trained. His insistence on these fundamentals, especially realistic training, helped save untold thousands of American lives. Because there has been no compilation of his papers, no biography has been written about General McNair to help him become known to the country that he loved and served. In 1954, Congress promoted him posthumously to the rank of general.

(Disseminating Terrain Data, continued from page 17)

heavy-equipment transports (HETs), moving map displays in cockpits of helicopters, integrated terrain display systems in armored vehicles, and backpacked soldier systems. Operators of these systems will be able to overlay operational graphics, weather data, friendly and suspected/known enemy locations, or even weapons fans on this accurate digital terrain data that is managed by the terrain team down as low as the maneuver-brigade level.

After warfighters have the digital terrain data, they will use the Joint Mapping Tool Kit (JMTK) or Tactical Mapping Tool Kit (TMTK) within the ABCS to manipulate and display the data. The Digital Topographic Support System (DTSS) terrain analysts will manage the data and database and establish the CTOE at the division and brigade levels. At the battalion level, the operations section performs these tasks. The senior engineer officer, the terrain-visualization expert, will continue to assist with establishing and maintaining the CTOE. He will work with the commander and staff to define the types of terrain data and detail of terrain analysis needed based on the planning requirements of the unit being supported.

What Types of Data Does the Concept Cover?

Several types of digital terrain data are required by the ABCS, weapon platforms, and land warriors to visualize an area of interest. Weapon platforms and the land-warrior system must identify the specific terrain-data requirements for foundation data and MSDSs. This article describes the established implementation plan for the dissemination of digital terrain data. While the concept and implementation plan appear sound, it depends on several developing systems and capabilities (such as the ABCS, the GBS, the JMTK, and the TMTK) that have yet to be tested in a full-up realistic training exercise. The devil is in the details. The role of engineer officers and terrain technicians is to help warfighters understand the FD Concept, establish a CTOE, and get digital terrain data to battle-command systems, weapon platforms, and Land Warriors within their organizations.

Mr. Ralph M. Erwin is the deputy director of the TRADOC Program Integration Office for Terrain Data (TPIO-TD). He was previoiusly a senior systems-integration engineer for Lockheed Martin Corporation and Computer Sciences Corporation. Mr. Erwin holds a degree in mathematics from Cameron University in Lawton, Oklahoma.

Correction

In the February 2001 issue, page 9, the e-mail address for requesting the mine-awareness video is incorrect. It should be *Douglas.Langrehr@polk-emh2.army.mil.*

The Adaptive Engineer Leader

By Lieutenant Colonel Christopher J. Toomey

As leaders and managers face rapidly changing environments and circumstances—at a pace accelerated by the dramatic influx of information that literally assails decision makers in the digital age—the search for new methods leads to a rethinking of leadership approaches needed to exercise command and control in our increasingly information-oriented Army.

Adaptive leadership postulates an approach that best fosters success in today's environment. In this article, I will define adaptive leadership, identify why it is useful for engineers, and identify some strategies that we can use to help nurture and grow adaptive leaders.

Defining Adaptive Leadership

There are a great many views on adaptive leadership within the literature. According to the Center of Army Leadership, an adaptive leader is—

> *"A leader who can influence people—by providing purpose, direction, and motivation—while operating in a complex, dynamic environment of uncertainty and ambiguity to accomplish the mission and improving the organization."*[1]

A major characteristic of adaptive leadership is the internalization and application of adaptive thinking. Adaptive thinking is the key to the art rather than the science of war. Adaptive thinking is characterized by—

- The ability to react to unexpected changes during operations.
- Knowing how to think rather than what to think.
- The ability to attain a multidisciplinary conceptualization of battlefield events and use this understanding to decide and act.[2]

In addition to these views on adaptive leadership and thinking, FM 22-100, *Army Leadership*, identifies four leadership skills that define the adaptive leader:

- Interpersonal – dealing with people.
- Conceptual – handling ideas and information.
- Technical – employing job-related abilities.
- Tactical – solving unit combat problems.[3]

Maximizing these skills within the context of adaptive thinking, it is evident that adaptive leaders are proactive and exert influence over their environment, not merely reacting to situations. Adaptive leaders use available information and their knowledge of their units to generate creative solutions to complex problems. By encouraging innovation and junior leader/soldier involvement in solving problems (rather than merely dictating top-down solutions), they create the conditions where their units actually grow and get stronger while meeting challenges.

But how does adaptive leadership apply to the engineer leader? Arguably, engineers traditionally perform well-defined tasks and missions. Our success is often predicated on what some consider near-mechanical execution.

Do we need adaptive leaders? To see a need for adaptive leadership and the need to develop adaptive leaders, we must identify the changing environment and situations that face our engineer leaders and then see how adaptive leadership can help.

The Engineer Challenge

If Army engineers only had to deal with their mission-training-plan-based tasks, then our need for adaptive leadership would perhaps be limited. All we'd need to do is train each soldier and subordinate leader to be a cog in a well-oiled machine. Most engineers would only embark upon tasks within the limits of their technical specialty. Combat-heavy engineers perform construction. Sappers prepare to breach and conduct demolitions. Perhaps an over-simplification, but by and large, engineers have often occupied and acted within a very well-defined and highly evolved niche within the military organization—deliberate operations in highly static environments that intentionally minimize ambiguity.

Today's reality is different. Today, we ask much more of our engineer leaders. We face innumerable and often conflicting challenges. Given the nature of small-scale contingencies (SSCs) and stability and support operations (SASOs), the same unit that must be expert in conducting the combined-arms breach must also be able to rapidly transition to rough vertical construction. Sappers who normally train with a mine detector find themselves building tent pads.

Few branches in our Army face more diverse challenges within the context of a single operation than the Engineer Regiment. Typically working with ad hoc units that are combined, joint, multicomponent, and include both military personnel and civilians, Army engineers are expected to face challenges as diverse as minefield clearing to demolitions to road construction. Engineers are expected to be troop leaders, technicians, diplomats, financiers, and moralists. Any examination of the role of engineers within SSCs and SASOs reveals that engineers are asked to "step up to the plate" across the spectrum of combat, combat-support, and combat-service-support functions.

Consider engineer operations in places such as Haiti or the Balkans. Aside from being prepared to conduct combined-arms operations before deployment, the same engineer leaders are thrust into situations where they must execute the full range of engineer missions, often with soldiers who are not routinely trained in the tasks. They work lines of communication, develop force-protection measures, oversee demining operations, and build/design bridges. They must do this in rapidly changing and often unpredictable environments—environments with multiple degrees of freedom that include competing objectives and pressures from nongovernmental and governmental agencies, tribal and ethnic groups, and often less-than-unified coalition forces.

Adaptive leaders use a mix of interpersonal, conceptual, technical, and tactical skills.

Engineer leaders and units must have an ability to change to meet the mission, to learn new skills and grow to the occasion. Success requires leaders who are able to deal with ambiguity by applying initiative within intent.

Training Adaptive Engineer Leaders

Engineers must consciously work to develop adaptive leaders. There are initiatives in place to integrate adaptive thinking and techniques into the formal Officer and NCO Education Systems. However, units currently have an opportunity to help develop adaptive leaders and adaptive thinking through imaginative use of their existing training programs.

Adaptiveness requires leader versatility. Nowhere is this more certain than in the engineers. Unfortunately, we often do not spend time developing versatility. Rather, engineer units often intentionally narrow their training focus. The drive toward specialization—perhaps overspecialization—is strong, particularly when so many of our units occupy "one-mission niches" in training environments such as the combat-training centers.

We do a great job of developing leaders within these particular niches—so much so that leaders often see themselves as specialists rather than gaining the breadth required of the generalist. Often junior engineer officers perceive themselves as "construction types," "topo experts," or "sappers only." NCO leaders—who by necessity and military occupational specialty are expected to have a greater degree of specialization—are also bound by their experiences. Yet, we must develop leaders who are familiar with the broad range of skills expected in SSCs and SASO.

Outside the unit, it is possible to expect service schools to build curricula that provide greater breadth. Versatility is also developed through a career of varied assignments. Yet, leaders at battalion level and below can use their own resources to develop the versatility and flexibility that define adaptive leaders.

"Adaptiveness requires leader versatility. Nowhere is this more certain than in the engineers."

One method is through a carefully orchestrated unit professional-development program. Varying subjects and resisting the urge to focus professional development strictly on short-horizon unit requirements can build a degree of technical and tactical versatility. For example, sapper units can dedicate occasional professional development to construction-management techniques while combat-heavy units can expose their leaders to obstacle planning.

Traditional professional-development programs, normally 2 to 3 hours per month, may not be enough. Consider the benefits of encouraging and supporting more time-intensive individual-development programs. In order to be a success, support needs to come with resources in both time and funding and a method to accurately assess and monitor progress.

Varying missions, particularly in home-station training, can actively develop versatility. Volunteer to build a concrete-masonry-unit building if you are a sapper unit. Construct obstacles and emplace the occasional minefield for the local personnel unit if you lead a unit with a communications-zone focus.

Other nontraditional approaches can include programs such as the 555th Combat Engineer Group's Junior Officer District Intern Program (see article, *Engineer*, October 2000, page 34). The Fort Lewis, Washington, program places junior officers with engineer districts for 3 to 4 weeks at a time. Not only is technical versatility fostered, but the junior officers also get to work with various groups to include Corps civilians and contractors, thus expanding interpersonal and conceptual skills.

Perhaps a greater challenge is creating the conditions where leaders can develop the interpersonal and conceptual skills necessary to foster adaptive thinking. Using the spectrum of unit events from field exercises to discussions based around vignettes, junior leaders are exposed to evolving situations that are carefully varied to present leaders with carefully escalating complexity and dilemmas.

While often trying to isolate the technical/tactical requirements of an event, an observation is that many home-station exercises are essentially oriented around battle drills and are stripped of the complexity junior leaders will routinely face during an SSC or SASO. Commanders should strongly consider the benefit gained from building increased ambiguity and asymmetric threats into their training scenarios. Factors to consider include introducing the media, nongovernmental organizations, force-protection issues, information operations, Active Component/Reserve Component integration, and refugees. In addition, situations that challenge our Army Values will cause leaders to give greater thought to their actions.

Exercises do not need to be resource-intensive field exercises. One technique that is used successfully in the Initial Brigade Combat Team at Fort Lewis is to have a series of seminars and discussion periods based around vignettes that challenge the leader's ability to develop adaptive thinking. The vignettes are not focused on one rank or level of command. Rather, they are geared to simultaneously engage multiple levels of command.

Mentorship and coaching play a key role in developing adaptive thinking. In developing adaptive leaders, mentor involvment must go beyond conducting after-action reviews and evaluating post-event performance. To maximize effectiveness, mentors must not only provide information and traditional feedback but also take on the role of coach and even fellow learner. This role is enhanced by the use of techniques such as scaffolding [4] to introduce new concepts. Scaffolding is the selective and incremental insertion of information at critical times during the problem-solving process. The effect is a continuum of feedback during the training event that leads the audience in working through the dilemmas encountered.

Summary

This article is a cursory effort to stimulate thought on adaptive leadership and how it may apply to engineer leaders. Clearly, the Regiment has a need to fully embrace adaptive thinking and must do so. Through adaptive leadership, units will be able to more effectively meet the challenges of today's rapidly changing environments. However, units need not wait for a top-down guidance on developing adaptive leaders. Rather, leaders at all levels should seek to understand adaptive thinking and work to integrate it into their training and professional-development programs.

A 1981 graduate of the United States Military Academy, Lieutenant Colonel Toomey commanded the 14th Combat Engineer Battalion and now serves as Chief C4ISR/Battle Command with the Army's Transformation Task Force.

Endnotes:

[1] "Defining Adaptive Leaders in the Strike Force Environment: THE ENDSTATE – A Doctrinal Approach," draft, 10 May 1999, p. 8.

[2] Dr. Karol G. Ross, "Training Adaptive Leaders. Are We Ready?," *Field Artillery Journal*, September-October 2000, p. 16.

[3] FM 22-100, *Army Leadership*. Fort Leavenworth, Kansas: U.S. Army Combined Arms Center, 31 August 1999, pp. 2-25.

[4] Ross, p. 16.

Transforming the 130th Engineer Brigade...

One Step at a Time

By Colonel Todd T. Semonite and Major Russ LaChance

In this day and age of Army Transformation, how do you transform its largest forward-deployed engineer brigade? The answer is—one step at a time, with existing equipment but new, deployable packages. The task of transforming U.S. Army Europe (USAREUR) and V Corps's 130th Engineer Brigade might seem to be quite overwhelming. The brigade's roots are firmly entrenched in the General Defense Plan days of Germany's forward-deployed heavy divisions. In those days, units didn't have to be strategically responsive or rapidly deployable beyond border assembly areas in eastern Germany.

As a member of the Legacy Force serving in the "Containment Corps," it will be several years before any of the revolutionary advances in technology or equipment evolving in the Interim Force at Fort Lewis, Washington, or the Digitized Corps at Fort Hood, Texas, appear in Europe. While several initiatives are taking place in engineer structures within our new Interim and Objective Forces, as well as potential changes to the current divisional force, the current echelon-above-division Legacy Force is not expected to change for the next 6 to 10 years. Change must come through creating a deployment mind-set in every soldier; modifying our capability packages with existing doctrine, equipment, and manning; and forcing our units to be trained and ready in task-organized, modular, mission-tailored packages.

In the last 6 years, each unit of the 130th experienced multiple deployments to the Balkans for extended rotations. Shorter deployments have stretched throughout the European Command's (EUCOM's) 98-country area of responsibility—from Former Eastern Bloc countries to humanitarian missions in Africa and the Caucasus. In the past year alone, the 130th's soldiers and units deployed to seven countries, sometimes with only a few day's notice. Each time we deployed, whether alone as engineers or as a member of a combined-arms force, our engineers had to rush to form nondoctrinal ad hoc teams that were trained and resourced at the last minute to meet the specific mission requirements. Although we were "versatile, lethal, survivable, and sustainable" (four of the broad goals of Army Transformation) during the execution of these missions, our strong reliance on rail or sea movement prevented us from being "responsive and deployable"— two key ingredients in the Transformation philosophy. While highly trained and tailored for a variety of high-intensity or peacekeeping missions, our echelon-above-division assets have been hesitant to adapt to rapidly deployable, airlift-configured modular packages to be on the ground when the mission was received.

Force-Enhancement Modules

In response to a call to create a rapidly deployable early-entry force in 1999, USAREUR developed the Immediate Ready Force (IRF) consisting of the M1-based Heavy Immediate Ready Company (HIRC), the M113-based Medium Immediate Ready Company (MIRC), and four unique-function "plug-and-play" Force-Enhancement Modules (FEMs). The purpose of the FEMs is to provide tailored capabilities for the IRF to perform its mission in a variety of environments. The IRF and the supporting FEMs are not new units but new capabilities, designed around rotational Brigade Combat Teams from the two USAREUR divisions. Building on intratheater airlift, the IRF and the FEMs are designed to move on C-130s organic to the theater with designated pre-positioned equipment warehoused at USAREUR's Deployment Processing Center in Ramstein. A deployment timeline of 7 days involves unit notification, movement to the deployment site, deployment processing, issuance of contractor-maintained equipment, and air-load and transit on C-130 airlift. Unfortunately, this relatively new concept was limited to divisional capabilities and did not include a role for the 130th Engineer Brigade in its present state. However, it provided the catalyst to begin the long road toward Transformation.

The 130th Engineer Brigade has proposed several FEMs to meet the needs of the IRF or to serve as stand-alone packages

"...while this initiative is not revolutionary or recommended as a permanent modification to our engineer force structure, it is the way that our brigade must adapt to meet the changing role of our forward-deployed units in USAREUR."

for other Southern European Task Force (SETAF), USAREUR, or EUCOM missions. We have eagerly taken this first step toward Transformation by simply packaging our existing forces and equipment into small, responsive, capable, deployable, agile, and versatile FEMs. This first step doesn't call for sweeping modified table of organization and equipment (MTOE) changes or force-structure manipulations. It simply helps us put plans on the shelf to establish training and movement packages, integrate members of several units into one cohesive and focused team, and build a spirit of readiness and deployability in our everyday routine. All FEM equipment is located at the home station, and FEM soldiers from various units are battle-rostered and trained in both the FEM mission and the deployment process. No personnel will be put on a heightened alert posture until a EUCOM warning order or deployment scenario is imminent. Once a quarter, each FEM will be processed through the USAREUR Deployment Processing Center with possible training missions via C-130 airlift conducted as part of a deployment or training exercise.

A critical piece of the 130th Engineer Brigade FEMs is the Tele-Engineering Suite communication package. This two-part package purchased from U.S. Army Corps of Engineers Waterways Experiment Station at Vicksburg, Mississippi, will accompany any deployed FEM. The nondeployable "base station" will be collocated with the sending battalion, and the deployable "suitcase" package enables secure communication anywhere in the world via satellite. The deployable package, which can run off of a high-mobility, multipurpose wheeled vehicle (HMMWV) battery, includes the ability to transmit not only voice, e-mail, and computer data but also conduct live, real-time video teleconferencing and send pretaped videos to the home station. The stand-alone nature of the package allows reach-back analysis, design, or technical expertise from the supporting battalion without any dependence on remote-location or IRF communication. Just recently, the 94th Engineer Battalion successfully incorporated the Tele-Engineering Suite on a reconnoiter to Mozambique. In addition, the Tele-Engineering Suite provides connection to the three Corps of Engineers Laboratories located in the Continental United States.

Each of our battalions carefully developed unique FEMs based on four major disciplines of our Regiment: combat engineering, construction, bridging, and topography. The following articles from three battalions in the 130th Engineer Brigade—the 94th, the 54th, and the 565th—provide more detail on how each battalion is meeting the Transformation intent as well as insight for other units' professional development. It is important to point out that while this initiative is not revolutionary or recommended as a permanent modification to our engineer force structure, it is the way that our brigade must adapt to meet the changing role of our forward-deployed units in USAREUR. If we hope to be value-added to our maneuver commands, Army engineers have to be the "phone call of first choice" over validated contractor capability or already-tailored sister services. While echelon-above-division force structure and equipment modifications are years away, this brigade is not going to wait to meet the current Army Vision and the Transformation process. Readiness, versatility, agility, and responsiveness are more mind-sets and battle cries than adjectives derived from your MTOE, Unit Status Report, or alert posture—the real Transformation we need to make as engineers is to become more relevant *today* with the tools and structures we have on hand. Internalizing that mind-set is the hardest step down the road of the twenty-first-century engineer—one that this brigade is going to take, one step at a time.

The Road Ahead

Each time the heavy force of the 130th Engineer Brigade has deployed, we have experienced our share of growing pains and challenges. Teams *have* been made, trains *have* been loaded, and the mission *has* been accomplished—but only through a great deal of stress, hard work, and nonstandard operations. Our new standardized FEM concept will reduce those growing pains and allow us to be more responsive in the future. We have already taken several steps toward implementation of the brigade's FEM concept. The V Corps commander and deputy commander, who were briefed in January, observed four of the actual FEM teams (members and equipment) and approved implementation of the concept. Coordination has been ongoing with USAREUR deployment staffs and the EUCOM J4 engineer shop on the enhanced capabilities.

FEMs will be activated in two bands: the first series will be the Medium Construction FEM, the Survey FEM, the Terrain-Analysis FEM, and the Engineer Reconnaissance FEM. Others will follow later in the year. Initial focus for the second and third quarters will be finalizing the teams, developing training and deployment procedures, and receiving supporting equipment.

The 54th Engineer Battalion is currently training soldiers on the miniflails. The Tele-Engineering Suite arrived in the brigade in February. HMMWV shelters were procured for the Terrain-Analysis and Survey FEMs in March, and the Panthers arrived in April. The final validation of the four FEMs will be programmed for early summer through the normal IRF validation exercise held by USAREUR at the Deployment Processing Center. The brigade is currently seeking EUCOM and USAREUR prefunded missions throughout Europe and Africa to allow full exercise and validation of the concept.

This first step of tailored FEMs with existing troop structures, predominantly MTOE equipment, and resourced training and deployment packages is our way of putting our brigade on the road to Transformation. This brigade must meet the goals and intent of the Army Vision, as well as the goals and intent of the USAREUR and V Corps commanders, to leverage the full potential of our outstanding soldiers and units. While continuing to be an active player in future engineer force structure and equipment initiatives within the engineer community, we will attempt to do everything in our power to meet the standards of quicker deployment and smaller, tailored, air-delivered packages when the EUCOM and USAREUR commanders need our services. Our brigade needs FEMs. Our Regiment needs to focus on leveraging those members of the Legacy Force to be relevant to today's requirements—not stuck in the Fulda Gap of the 1980s. We need to take this one step at a time.

Colonel Semonite commands the 130th Engineer Brigade, Hanau, Germany.

Major LaChance is the S3 of the 130th Engineer Brigade.

94th Engineer Battalion (Combat) (Heavy) FEMs

By Captain Brian Baraniak

The 94th Engineer Battalion created three FEM packages to provide rapid, initial-entry construction capability until heavier, more robust engineer forces can close on the area of operation. These packages can also be the sole response to less resource-intensive contingency operations. The construction FEM packages introduce versatility and deployability that is normally not associated with combat-heavy units. The construction FEMs provide maneuver commanders with a unique capability utilizing construction assets with minimal impact on logistical resources.

Three packages, each building on the previous (or lesser) one, make up the 94th's FEMs: light, medium, and heavy. The table on page 55 provides a summary of the packages and their capabilities and some sample construction missions.

The FEM packages utilize a wide range of construction-engineer equipment. This includes the MTOE-authorized 763 Bobcat skid-steer loader. The Bobcat's special attachments (forklift, bucket, backhoe) provide limited earthmoving and lifting capabilities. Each package also includes M998 HMMWVs; M929A3 5-ton dumps trucks; various sets, kits, and outfits; standard integrated command-post shelters (SICPS); communications systems; surveying equipment; a shower unit; and a 5 kW generator. As the size of the FEM package increases, so does the construction capability. The medium package adds a hydraulic electric tool outfit (HETO) trailer with a 3.5 kW generator and numerous hydraulic tools. The heavy package has all equipment in the medium package plus a FLU 419 small emplacement excavator (SEE) and two M105 trailers. Depending on mission requirements, it is possible that the FEM package might include the bill of materials for

A soldier briefs the V Corps commander on the 94th Engineer Battalion's Medium Construction FEM package.

Construction FEM - 3 Packages

	Light	Medium	Heavy
Mode	3 x C-130	4 x C-130	12 x C-130
Time to DPC	<96 hours	<7 days	<7 days
Mission Duration	<30 days	30-45 days	45-90 days
Personnel	15	30	60
Base-Camp Size	Tier II 150-man camp 10 x bunkers	Tier II 250-man camp 17 x bunkers	Tier II 1,000-man camp or SEAHuts 450-man camp 25 x bunkers + berms
Missions	Bunkers Culverts Headwall Airfield matting Limited electrical utilities Water distribution Limited drainage operations	Light + Sewage systems Small concrete structures	Medium + Repair bridges Steel-frame structures Coupled pipelines Excavation operations Combat roads Tank ditches Vehicle fighting positions Berms Revetments Helipads

Mission Examples

- Schools
- Clinics
- Storage facilities
- Base camps
- Refugee camps
- Forward operating bases
- Force-protection structures
- Multipurpose facilities
- MWR facilities
- Detention facilities
- Housing
- QA/QC
- Surveying
- Materials testing

94th Engineer Battalion Construction FEM

prefabricated bunkers, guard towers, tents, or latrines preconfigured and stored in home-station warehouses.

With the help of the 130th Engineer Brigade, the 94th is currently considering additional equipment for the FEM packages. This equipment includes a 15-ton tilt-bed trailer, which is extremely useful in transporting the 763 Bobcat and other equipment and is small enough to fit on a C-130. Future plans might involve the acquisition of two C-130-deployable JD 450/550 dozers to increase the earthmoving capabilities of the heavy package.

The potential of the construction FEMs is a more versatile, deployable, and capable engineer construction capability. Continued development of the FEM package and the addition of new technology and equipment will make this unique USAREUR rapid-construction capability a compelling combat multiplier.

1-800-BASECAMP. When the 94th Engineer Battalion gets called to provide humanitarian assistance to Mozambique during a severe flood, it is postured to respond almost immediately with a well-trained and -resourced team. The medium FEM package offers a diverse construction capability that flies soldiers and equipment downrange or worldwide within 7 days to build emergency life-support facilities. By incorporating FEMs into battalion deployment and training plans now, the unit can rapidly respond to EUCOM missions at least as expediently as our sister services.

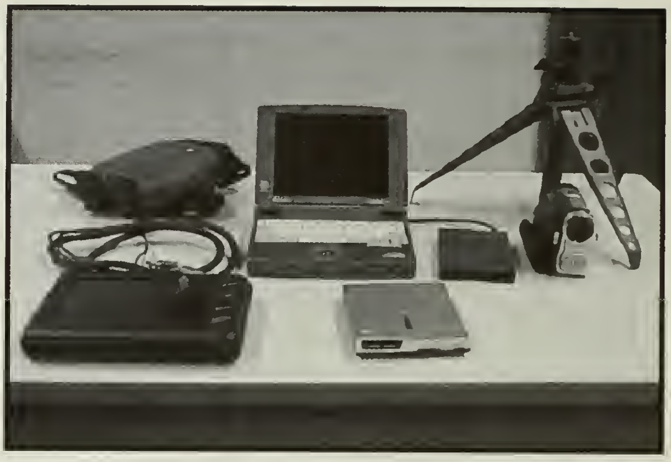
Captain Baraniak is the S3 Plans Officer, 94th Engineer Battalion, Vilseck, Germany.

54th Engineer Battalion (Combat) (Mechanized) FEMs

By Lieutenant Colonel Bill Rapp

Currently, the combat-engineer contribution to the rapid-deployment capability of USAREUR is the "Sapper FEM." This package consists of four M113A3 armored personnel carriers and a robotic, trailer-mounted miniflail. A line platoon from the divisional engineer battalion of the "ready" Brigade Combat Team rotates monthly to perform the Sapper FEM mission. The platoon comes to the fight with its usual complement of AN/PSS-12 mine detectors, demolitions kits, and selected pioneer tools. This platoon has no specific training on robotic mine-clearing vehicles like the miniflail and has the training and equipment necessary to conduct only rudimentary, nondigital engineer recon.

While the current Sapper FEM provides the MIRC or HIRC commander with critical mobility skills in an austere environment, the package has serious shortcomings. In addition to supporting USAREUR's IRF, the 54th Engineer Battalion's relationship with SETAF has generated several new requirements for engineer forces that cry out for rapidly deployable packages of engineer capability not offered by its organic light sapper detachment. The intent of the 54th Engineer Battalion's Engineer Reconnaissance FEM and Countermine FEM is to provide USAREUR's initial-entry force with additional tools greatly needed to facilitate follow-on-force entry into EUCOM's area of operations.



Equipment in the Engineer Reconnaisance FEM

Engineer Reconnaissance FEM. In order to bring heavier forces into the area of responsibility, rapid but thorough recon of transportation infrastructure is essential. As USAREUR found when bringing forces into Kosovo through Albania in 1999, detailed recon of routes, bridges, water crossings, and critical facilities is a first step in heavy-force entry. That kind of recon, with the capability to send data and photos of critical structures back to experts in both EUCOM and the U.S. Army Corps of Engineers, does not currently exist as a planned package for rapid deployment. The Engineer Reconnaissance FEM provides that capability on one C-130 transport.

The Engineer Reconnaissance FEM centers on a suite of automations and communications equipment known commercially as the Penmap system, which is on hand in the 54th Engineer Battalion. The following features, shown in the photo above, comprise this reconnaissance system.

Laser binoculars, called Vipers, attached to a standard precision lightweight Global Positioning System (GPS) receiver (PLGR), give precise grid coordinates of lased objects. The Viper's internal software package also computes bridge heights, facility widths, road slopes, and a host of other critical measurements. The Windows-based computer, currently loaded with Penmap software and with an associated Sunscreen handheld display, allows the operator to write directly on a digital map of the area while simultaneously recording key measurements on digital forms. Digital still and video cameras capture photographs of facilities and key structural members for reach-back analysis by nondeployed subject-matter experts. All of the digital information thus recorded—the measurements and images—can be transmitted through both a standard Single-Channel, Ground-to-Air Radio System (SINCGARS) using DataBurst or through the deployable Tele-Engineering Suite that will be part of the Engineer Reconnaissance FEM.

Six soldiers, two M998 HMMWVs, and one 3/4-ton trailer make up the base configuration of the Engineer Reconnaissance FEM. An engineer lieutenant leads the team and is focused on coordination with the IRF leadership, tactical employment of the team, and logistics. Two separate recon teams, each led by an engineer sergeant and assisted by a military occupational specialty (MOS) 12B sapper, conduct the actual recon missions. An MOS 31U communications specialist provides the expertise for transmitting the digital data to subject-matter experts and higher staffs. The FEM is expandable to eight soldiers if an MOS 62N30 horizontal-construction supervisor and U.S. Air Force Combat Control Team member are needed for a more detailed assessment of roads and airfields respectively.

The configuration and capabilities of the Engineer Reconnaissance FEM provide a superior intelligence capability for the follow-on-force commander and planners.The Reconnaissance System Suite of electronic tools can be easily adapted to vehicle or man-packed operational recon, if required by the force, in addition to the standard engineer recon of transportation infrastructure and terrain. The compact size of the FEM is also its primary shortfall. It lacks heavy weapons and armor for self-protection and has only minimal sustainment

The miniflail will clear, neutralize, or otherwise destroy all types of surface-laid or shallow- buried antipersonnel mines.

A soldier from the 54th Engineer Battalion demonstrates the capabilities of the Reconnaissance FEM, which includes Viper laser binoculars and digital still and video cameras.

capabilities. However, as part of a larger IRF insertion, this FEM provides the tools necessary for planners to bring in a more robust ground presence.

Follow-On-Force Entry: As the Army transforms to be more deployable and immediately salient to the CINCs, rapid assessment of the existing road, bridge, and airfield infrastructure in places like Albania or the flood-ravaged countryside of Mozambique will be the linchpin to successful heavy-force entry in coming years.

Countermine FEM. While the Engineer Reconnaissance FEM is ready to deploy now with all equipment on hand, the 54th Engineer Battalion's Countermine FEM is an evolving package dependent on fielding countermine equipment to the unit. At its end state, this FEM will consist of a tailored package centered on an enhanced sapper platoon and robotic mine clearers. What makes this package different from the standard Sapper FEM will be the inclusion of the Army's newest countermine equipment, such as the Handheld Standoff Mine-Detection System (HSTAMIDS), the follow-on handheld mine-detection system, and other equipment found in the Countermine Capabilities Set (CMCS). The 130th Engineer Brigade is currently working with the Engineer School to posture a CMCS in Europe as well as procuring other engineering countermine systems.

In July-August 2001, two M1 Abrams Panther robotic mine proofers will be fielded to the 54th Engineer Battalion for training and possible support to the heavy company of the IRF, if needed. With the assets of the CMCS and robotic mine clearers, the 54th is postured to become the countermine center of expertise for contingency operations in EUCOM's area of responsibility.

At present, A Company, 54th Engineer Battalion, possesses and is trained to use the miniflail mine clearer. As shown in the photo on page 56, the miniflail is a lightweight, self-propelled, robotic mine clearer designed to clear footpaths or small areas of antipersonnel mines. Although the miniflail is currently included in the Sapper FEM, long-term training proficiency and subject-matter expertise are prevented by the monthly rotation of units. The 130th Engineer Brigade is currently developing a proposal to align A Company soldiers as the permanent miniflail team inside USAREUR's Sapper FEM.

As more components of the CMCS are procured and fielded to the 54th Engineer Battalion, a more robust, stand-alone countermine package will be created for contingency operations. Eventually, this will become a sapper platoon capable of providing point and lane countermine support to both combat forces like the IRF and contingencies in low-intensity environments, such as embassy support and assistance to humanitarian-relief missions in disputed regions.

Countermine Experts: When the 1st Armored Division Engineer Brigade's task force deployed to Bosnia in the winter of 1996, the 54th Engineer Battalion was one of three engineer battalions to conduct initial-entry operations in the Zone of Separation. Throughout the early '90s, the battalion had served as USAREUR's countermine experts, proficient on several fielded systems that had very unique capabilities not present or trained in the divisional battalions. On countless occasions, small trained packages of unique capability were deployed to perform countermine missions using specially tailored equipment. This FEM reestablishes that subject-matter expertise in a dedicated unit having rapidly deployable, trained teams with unique systems needed to support maneuver commanders.

Lieutenant Colonel Rapp commands the 54th Engineer Battalion, Bamberg, Germany.

565th Engineer Battalion FEMs

By Major George Simon

The 565th Engineer Battalion has a unique structure that gives us the flexibility to develop diverse engineer modules. The battalion consists of three separate engineer companies: the 38th Engineer Company (Medium Girder Bridge [MGB]), the 320th Engineer Company (Topographic), and the 502d Engineer Company (Assault Float Bridge [AFB]). With these companies, we developed four different FEMs to expand engineer support to the USAREUR IRF or to the SETAF commander.

The four engineer teams include two topographic teams and two bridging teams. The topographic teams are a survey module and a terrain-analysis module. The bridging teams are a fixed-bridge reconnaissance/bridge-construction module and a float-bridge rafting module. All teams use existing equipment and soldiers within the battalion. The only additional equipment required is the 130th Engineer Brigade's deployable Tele-Engineering Suite.

Survey FEM. The mission of the survey module (Table 1) is to deploy, on order, within the EUCOM area of responsibility to provide survey control points, conduct airfield surveys, and provide points for map orthorectification. Artillery and air-defense units use these very accurate survey control points to calibrate their positioning systems before firing. This is especially important when operating in an environment where civilians are present.

In undeveloped areas, the survey team can lay out airfields and provide aviators with obstruction data for the airfield. Since topographic land maps do not exist in many areas of EUCOM, the survey team will establish control points with which the National Imagery and Mapping Agency can develop military maps from satellite imagery. The survey team operates from a specially configured HMMWV modeled after the Digital Topographic Support System-Survey (DTSS-S), which is still in the concept stage of fielding.

The Survey FEM provides survey control points, conducts airfield surveys, and provides points for map orthorectification.

Survey

Personnel

Surveyor
1 x SSG 82D30
Surveyor
1 x SGT 82D20
Surveyor
2 x SPC 82D10

Aircraft requirements
1 x C-130

DTSS-S

Equipment

1 x M998 with shelter and SINCGARS
1 x Laptop computer with printer
1 x General-purpose (GP), small tent
4 x Global Positioning Systems (GPSs)
2 x Night-vision goggles (NVGs)
2 x Total station (survey - AISI)
1 x Tactical satellite (TACSAT) and Tele-Engineering
1 x Trailer-mounted tactical quiet generator (TQG)

Concept - Establish 4th-order survey control ISO Field Artillery Deep Attack (tested at Task Force Hawk, Task Force Falcon, and Victory Strike), map updates/registrations, or airfield surveys.

Table 1

Life Flights: After more flooding in several African countries, the United States Agency for International Development starts food and medical supply shipments via C-130 aircraft. Before the aircraft arrive, the Survey FEM has established survey controls on numerous dirt airstrips so the C-130s can land and deliver their much-needed cargo.

Terrain-Analysis FEM. The terrain-analysis module's mission is to deploy, on order, within the EUCOM area of responsibility to provide terrain-analysis products and small quantities of topographic maps to deployed headquarters. The team creates the terrain-analysis products on-site, operating from the supported unit's tactical-operations center with computers, graphics software, and map-printing capability. Sample products include modified combined-obstacle overlays (MCOOs), lines-of-communication maps, bridge/road maps, elevation maps, large-scale (1:25,000; 1:15,000) maps of the area of operations, satellite-imagery maps, anaglyphs (three-dimensional [3-D] red-blue maps viewed with 3-D glasses), fly-through videos, and almost any other type of map the commander may want.

If the requirement exceeds the time available or technical capability of the deployed FEM, the workload can be electronically transferred to the 320th Engineer Company's base station for reach-back capability. Once an electronic product has been completed, it can be sent secure via the deployable Tele-Engineering Suite and printed out at the remote site for the maneuver commander. The terrain-analysis team operates from a specially configured HMMWV ambulance modeled after the Digital Topographic Support System-Light (DTSS-L) (to be fielded to the unit in FY03).

Terrain Analysis

Personnel

Terrain analyst
1 x SGT 81T20
Terrain analyst
2 x SPC 81T10

Aircraft requirements
1 x C-130

Equipment

DTSS-L
- 1 x M998 with shelter and SINCGARS
- 1 x Laptop computer with printer
- 1 x GP, small tent
- 1 x GPS
- 2 x NVGs
- 1 x HP Kayak system with plotter
- 1 x TACSAT and Tele-Engineering
- 1 x Topo database
- 1 x Trailer-mounted TQG

Concept - Provide an enhanced digital terrain-analysis capability to the IRF or any deployed force up to brigade-size; product list includes MCOOs, elevation tints, 3-D maps, overprints, topographic line maps (TLMs), fly-throughs, etc.

Table 2

Deep Strike: As the 173d Infantry Brigade (SETAF) prepares for a counterinsurgency mission in Kosovo, the Terrain-Analysis FEM—a part of the initial deploying forces—identifies drop zones, landing zones, dismounted infiltration, and attack routes and produces limited maps and overlays of the area of operations.

These two topographic module prototypes have been extensively tested in many recent deployments and training exercises. The personnel and equipment for the terrain-analysis module are shown in Table 2.

Fixed-Bridge-Reconnaissance/Bridge-Construction FEM. The third team from the 565th Engineer Battalion is the fixed-bridge-reconnaissance/bridge-construction module. The mission of this module is to deploy, on order, within the EUCOM area of responsibility to conduct bridge reconnaissance and to provide technical expertise and supervision in the construction of fixed bridges using U.S. Department of Defense (DoD) or host-nation labor. The capabilities of the fixed-bridge module include determining the load classification of existing bridges, estimating the need for and extent of repair to existing bridges, and calculating the materials required for new bridges, specifically the Bailey bridge, the Mabey-Johnson (Compact 200) bridge, and timber-trestle bridges. The soldiers of the team will supervise the construction of the new bridges using DoD or host-nation armed forces or host-nation contracted labor. Because of the cost and size of the medium-grider bridge, the team will generally not use it for host-nation support. This team will operate from a HMMWV.

In February 2001, the battalion exercised the fixed-bridge-reconnaissance/bridge-construction FEM during Operation Ice Bridge, a battalion-level FTX that included a company-level external evaluation (EXEVAL) of the 38th Engineer Company (MGB) and platoon-level. EXEVALs of the 502d Engineer Company (AFB). The MGB company sent the FEM to link up with the "mayor" of a town that needed a Bailey bridge to replace a destroyed bridge. The FEM NCOs directed "unskilled local labor" (soldiers from the AFB company) in the construction of the Bailey bridge. Since most of the soldiers from the AFB company were not proficient with the Bailey, this was a good first test of the FEM. Potential future tests involve sending the FEM to Portugal to examine a collapsed bridge or to Poland as part of V Corps's Victory Strike exercise to examine and improve bridges over which the Multiple-Launch Rocket System (MLRS) vehicles will cross. The personnel and equipment associated with this module are shown in Table 3, page 60.

A soldier operates the computer hardware and software included in the Terrain-Analysis FEM.

Fixed Bridge

Personnel

Combat bridge crewman
1 x SSG 12C30
Combat bridge crewman
2 x SGT 12C20
Combat bridge crewman
1 x SPC 12C10

Equipment

1 x M998 with SINCGARS
1 x Laptop computer with printer
1 x GP, small tent
1 x GPS
2 x NVGs
1 x Fixed-bridging manual set
1 x TACSAT and Tele -Engineering

Aircraft requirements
1 x C-130

Concept - Conduct bridge and route reconnaissance and supervise construction of Mabey Johnson/Bailey bridges.

Table 3

Float-Bridge Rafting

Personnel

Combat engineer
1 x OIC 21B
Combat bridge crewman
1 x SSG 12C30
Combat bridge crewman
5 x SGT 12C20
Combat bridge crewman
15 x SPC 12C10

Equipment

2 x M998s with SINCGARS
1 x Laptop computer with printer
1 x GP, medium tent
1 x GPS
24 x NVGs
3 x MK1/MK2 bridge-erection boats (BEB)
2 x Ramp bays, bridge, floating (RBBF)
5 x Interior bays, bridge, floating (IBBF)
1 x TACSAT and Tele -Engineering
2 x Rubber boats (RB)-15
1 x ISU-90
10 x M945 bridge transporters

Aircraft requirements
6 x C-17s

Concept - Provide a wet-gap crossing capability for the MIRC and HIRC or for a humanitarian-assistance operation (6-bay raft = MLC 70).

Table 4

Bridge the Gap: The series of recent earthquakes in Turkey destroyed most bridges, rendering many roads impassable. With the United States sending fixed bridges like the Bailey bridge into remote areas of the country, the Fixed-Bridge FEM NCOs direct and assist Turkish forces in constructing the bridges. Finally, relief supplies flow into the ravaged towns.

Float-Bridge Rafting FEM. The final team from the 565th Engineer Battalion is the float-bridge rafting module. The rafting module will deploy, on order, within the EUCOM area of responsibility to provide a water-obstacle crossing capability to U.S. or host-nation forces. The rafting module is designed around a six-float raft that will support both the MIRC in USAREUR (M113-based) and the HIRC (M1- and M2-based). The module can also be used in humanitarian as well as peacekeeping operations. Potential missions include conducting evacuations and river patrols and ferrying equipment and personnel.

The rafting module is much larger than the survey, terrain-analysis, and fixed-bridge modules, as shown in Table 4. Given the size of the rafting equipment, many more airframes are required for transport. This module can be further reduced, if necessary. We will exercise this module during the summer of 2001.

Ride the Wave: The USAREUR rapid-reaction force deploys to a contingency in the EUCOM area of responsibility. The enemy has destroyed the one bridge on the river dividing the country. The rafting FEM deploys, allowing U.S. forces to cross the river. Later, the rafts transport refugees to safety during a mass exodus from the area of fighting.

The four modules from the 565th Engineer Battalion will significantly enhance the ability of USAREUR's rapid-deployment forces to operate in a contingency theater of operations. The survey and terrain-analysis modules have been tested in both deployments and training exercises, while the fixed-bridge and rafting modules were tested in February and will be again in June 2001. These engineer modules will continue to move the battalion along the road to the more versatile and deployable Army of the future.

Major Simon is the S3 of the 565th Engineer Battalion, Hanau, Germany.

Sappers Transformed

By Captain Daniel J. Taphorn

During the annual ENFORCE conference at Fort Leonard Wood, Missouri, in May 2000, I listened to some of the Army's top leaders speak on the future of the Army and the Engineer Regiment. As I learned of the developments taking place within the Army and specifically the Regiment, I could not help but wonder at the monumental task this undertaking has become. Those of us who have stayed relatively informed of Army Transformation initiatives have feelings of excitement, intrigue, and skepticism. After all, with change comes an element of uncertainty and, as soldiers, we have an understandable reluctance about our mission if there is ambiguity lingering in the air. Nevertheless, the future is coming, and all of us will have a chance to play a role in its formation.

During ENFORCE 2000, the Chief of Staff of the Army, General Eric K. Shinseki, talked about the future fighting force of the Army as one yet to be defined but possessing several qualities. It must be responsive, deployable, agile, versatile, lethal, survivable, and sustainable to support our requirements for the full spectrum of conflict.[1] Consequently, the Initial Brigade Combat Teams (IBCTs) are being task-organized to meet these requirements. But what exactly are these new brigade combat teams?

They are roughly defined as highly mobile, full-spectrum-trained, logistically sustainable, rapidly deployable forces whose strengths come from the exploitation of technology and speed. They aptly support General Shinseki's three rules of warfighting: (1) win on the offense, (2) initiate on our own terms, and (3) build momentum rapidly.[2] With the future operational landscape increasingly being small-scale contingencies, peacekeeping operations, and peace-enforcement operations on urban terrain, I—as well as others—have concerns about engineers supporting mobility requirements for these IBCTs.

Sappers Forward

Ask any steely-eyed sapper what engineers do in the offense, and he'll tell you that we breach hard and fast. Survival in the breach is a difficult prospect for sappers. Add in the complexities of an urban environment, and the bar is raised—which is why I believe that these selfless sons and daughters of America deserve the best training and the most technologically advanced equipment the Army can afford.

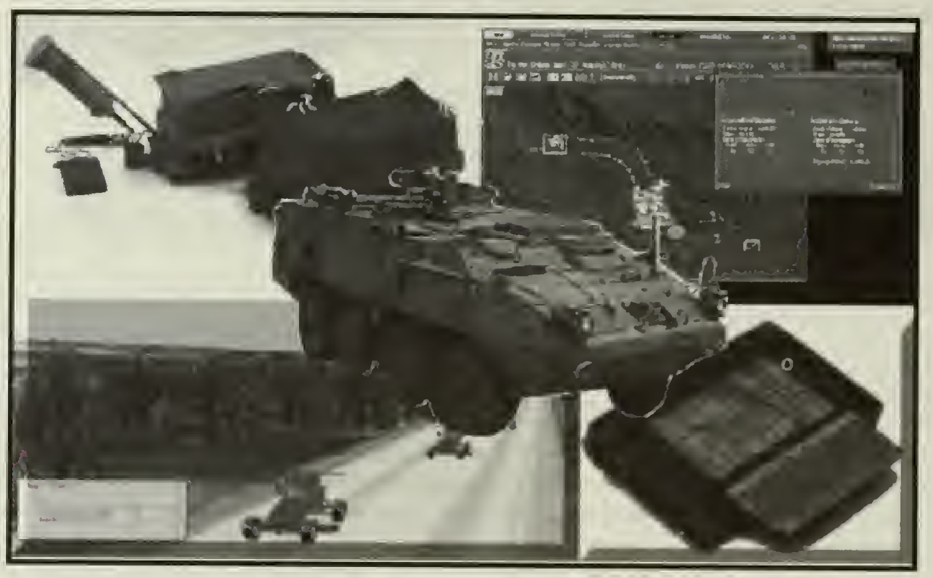
One area that is being improved is countermine training. Currently, we have engineers deployed in 73 countries around the world, and several of these soldiers are supervising, and conducting training on, humanitarian demining operations. In the former Yugoslavia, there are perhaps as many as 6 million mines littering the countryside, or roughly 15 mines for every square kilometer. (See article "Mine Threats in Mission Areas" in *Engineer*, February 2001, page 4.) The different types of mines number in the thousands. There are some unassuming mines out there that are cleverly disguised and employed in unorthodox manners. Our soldiers need to know this.

As a platoon leader in the 326th Engineer Battalion, 101st Airborne Division, Fort Campbell, Kentucky, my maneuver task force played opposing force (OPFOR) on one occasion for one of the infantry brigades. My platoon was responsible for countermobility operations in support of the OPFOR. Although I requested Class IV/V supplies, my platoon was left to fend for itself. So we gathered a miniscule amount of training mines and wire from our own stocks and set off to emplace some point obstacles along potential Blue Force (BLUEFOR) avenues of approach. To make a long story short—with a little sapper ingenuity, my poorly equipped OPFOR engineer platoon managed to stop a brigade maneuver element for several hours while its leaders figured out how to breach our obstacles.

How did we do it? We used whatever we could find. We created rubble obstacles with large rocks and fallen trees that we placed across roads and anchored with pickets and wire. And we threw in a few buried mines in the rubble for good measure. Unorthodox—yes; realistic—definitely.

Despite our success, the whole episode upset me—a brigade in the most powerful Army in the world was stopped by my unequipped sapper platoon. Needless to say, there were some lessons learned that day, but all I could think of was what might have happened if we had been properly equipped? And how would my platoon have fared if the shoe had been on the other foot? It was then that I wondered, Why aren't there OPFOR minefield/obstacle kits that we could use in tactical scenarios?

Granted, the sheer number of foreign mines would make it difficult, if not impractical, to reproduce training mines for all of them. But it would be helpful to be able to see, feel, emplace, and breach a VP-13 Seismic Mine Control System, a PMA-3, or an MRUD/PMA-2 booby trap. These are some of the numerous



Engineer Developmental Systems

antipersonnel mine systems used in Bosnia and Kosovo where currently some 11,000 U.S. troops are deployed and rotating on a regular basis.

In humanitarian demining, we have the luxury of having time to be methodical and deliberate in order to reduce the risks to our soldiers to a tolerable level. This luxury, however, doesn't exist in countermine operations when you're taking fire and blowing down doors to clear hostile buildings in an urban environment.

Imagine going to the Training Support Center and drawing several large plastic boxes like the ones that hold Multiple Integrated Laser Engagement System (MILES) equipment. You open the lid and there, separated neatly and encased in foam, are several of the most common types of foreign mines used in a specific geographic area. Upon further examination, you find that there are instructions with each type of mine system with a complete history of the mine, its employment, and how it's armed and disarmed. Just when you thought it couldn't get any better, you find out that you can actually arm the mines by emplacing a small explosive cap—similar to the cap guns that you played with as a kid. Now you have the ultimate foreign-mine training system. Soldiers will tell you that those mine-identification cards are helpful, but show him something similar to what I described, and those cards will become vivid reminders of the three-dimensional killers they are attempting to avoid or are seeking to destroy.

The above proposal addresses only one aspect of our mobility tasks and just scratches the surface of engineer Transformation issues. I only raise the countermine-training issue as an example because of its significance to the Engineer Regiment. There are equally important Transformation issues that apply to our other Battlefield Operating Systems. However, the fact remains that we're putting a heavy burden on the shoulders of our soldiers. So shouldn't we make it as easy as possible for them to learn and absorb information so they can truly become masters of their trade?

Soldiers Are the Bedrock

During ENFORCE 2000, then Maneuver Support Center (MANSCEN) Commander Major General Robert B. Flowers pointed out in his "State of the Engineer Regiment" presentation that one of the major characteristics of the Objective Force is versatility and that this is and will be a great leadership challenge.[3] At the same conference, TRADOC Commander General John N. Abrams explained, "As we push more power into the hands of fewer people in smaller organizations, the importance of each individual's contribution and effectiveness will remain."[4] My translation: Engineers get more technologically advanced equipment, are expected to know more, do more, and still get the job done.

Sure, we're going to have more complex scenarios, rules of engagement, operational environments, equipment, and—undoubtedly—more complex tactics, techniques, and procedures (TTP) and "asymmetric forces," and engineers will continue to be experts in their trade. But the truth is, this isn't just an engineer challenge. If history is any indication of things to come, soldiers Armywide will embrace the new challenges and, when the time comes, will step up to the plate and perform admirably as they have always done.

By the way, the time is now, and soldiers like those involved in engineer platform testing have been energetically participating in the transformation process. The technology being tested, if properly utilized and designed, should make our jobs easier. But just ask any computer user; it's a love-hate relationship, and it's likely to remain that way as we go through this process and work out the bugs.

The Directorate of Training Development (DOTD), the Directorate of Combat Developments (DCD), the Countermine Training Support Center (CTSC), and other agencies at Fort Leonard Wood are taking positive steps toward supporting the future engineer force. The Warrior Department of DOTD is laying down the foundation for a Master Breacher's Course, which is still early in development. The Countermine Capability Set (CMCS), Ground Standoff Minefield-Detection System (GSTAMIDS), Interim Vehicle-Mounted Mine Detector (IVMMD), Handheld Standoff Mine-Detection System (HSTAMIDS), and numerous other initiatives are big steps toward increasing our survivability and maintaining our mobility in our future operational environments. But as then Major General Flowers pointed out at ENFORCE 2000, "We are several years away from being able to neutralize every mine we come across."[5] That is assuming first that we are prudent, informed, and trained well enough to identify them beforehand.

In an article in the February 2001 issue of *ARMY*, Retired Brigadier General Huba Wass de Czege and Major Jacob D. Biever listed "guidelines for the Army's future Transformation." One of several key points in the article was that "Soldiers—not technology—are the key to continued superiority."[6] In TRADOC Pamphlet 525-5, *Force XXI Operations*, former TRADOC Commander General William W. Hartzog iterates the fluid nature of Army Transformation, "Change is so rapid, so pervasive, and so complex that the work of crafting the Army for the next century is now everyday work for us all."[7] The Army Vision *(http://www.army.mil/armyvision)* states first and foremost that "The Army is People." The Engineer School (*www.wood.army.mil/eschool/*) Web site has a link, "One Voice," which documents top engineer priorities. In his article "One Regiment, One Fight" in the April 1999 issue of *Engineer*, now retired Lieutenant General Joe N. Ballard, then Chief of Engineers, wrote, "Without a dedicated effort at every level, unity cannot be achieved. Ultimately, the future of the regiment is in your hands. We can continue working in our isolated cells and performing marginally, or we can realize the benefits of applying our collective power to the Regiment's problems."[8] The roles that soldiers play on a day-to-day basis are critical, and when those efforts are combined, the Army realizes its greatness.

Lend Me Your Ears

As a platoon trainer for the Engineer Officer Basic Course, I've mentored nearly 200 second lieutenants who, I'm sure, are all doing great things for the U.S. Army and the Engineer Regiment. I hope that those of you who read this article will pay special attention. You are down where the rubber meets the road, and your combined input from the field is essential toward doctrinal and technological development. If you're not already playing some role in Army Transformation, take the time to educate yourself and your soldiers, because the Army of the Future is yours, theirs, and mine. Our battalion commanders may not be around to see it, so we should take on the responsibility of making this Army what it is envisioned to be.

After all, isn't that what the new Army Motto, "Army of One," is trying to get across—that you or I, the soldier, can make a difference? Isn't it about empowerment and through that power fulfilling our obligations and living up to the Army Values? Despite the controversy surrounding it, I believe that the new motto is well-suited to the issue at hand, because the accomplishments and contributions of individuals over the years have been largely responsible for making this Army great. I believe this trend will continue.

Where do we start? The Fort Leonard Wood Web site is an excellent resource. Several departments within the MANSCEN and the Engineer School play roles in Army Transformation, including the Directorate of Training (DOT), DCD, and DOTD. The Engineer Concepts Tiger Team, under DCD, has the mission of ensuring that the engineer force is properly integrated into the IBCTs. You can download a copy of Field Manual (FM) 5-2, *Initial Brigade Engineer Combat Operations*, at this site to get the in-depth look at engineers in the IBCT.

An excellent resource for general Army Transformation knowledge is "The Hooah Guide to Army Transformation" in the February 2001 issue of *ARMY*. If you haven't read it, you can go to (*www.ausa.org/armyzine*) and click on "Army Magazine Archive" to view the issue. The Army home page has several links. For information on Army Transformation, see (*www.army.mil/armyvision/chain.htm#transform*). There are several other links on the Web, but these will get you going in the right direction.

Engineer School/MANSCEN Web Sites

Directorate of Training
www.wood.army.mil/DOT/dot.htm

Directorate of Combat Developments
www.wood.army.mil/DCD/dcd.htm

Directorate of Training Development
www.wood.army.mil/DOTD/dotd.htm

Engineer Concepts Tiger Team
www.wood.army.mil/econcept/

Center for Engineer Lessons Learned
www.wood.army.mil/cell/index.htm

ENFORCE Conference
www.wood.army.mil/eschool/e2001

Council of Colonels Conference
www.wood.army.mil/eschool/CofC/revision.html

Finding the Way

How do you get your engineer ideas across? First, ask your chain of command to review your recommendations for accuracy, completeness, and quality control. Although contacting departments in the Engineer School directly with your issues is a good way to give constructive feedback to the school, finding the right department can be a daunting task. Look at the MANSCEN Web site to find appropriate points of contact through the "Departments and Directorates" link.

Issues concerning changes to engineer publications—FMs, mission training plans (MTPs), soldiers training publications (STPs)—should be submitted using the DA Form 2028, *Recommended Changes to Publications and Blank Forms*. The DOT's Doctrine Development Division in the Engineer School, through the Center for Engineer Lessons Learned (CELL), collects information from the field and ensures that feedback gets to the right agency. If the issue is clearly a training issue, then it should be routed through the Training Development Integration Office for the Directorate of Training. There's also the Doctrine, Training, Leader Development, Organization, Materiel, and Soldiers (DTLOMS) Integrator and the Chief of Staff of the Engineer School, who ensure that issues are broken down and handled by the appropriate agencies. Issues that require higher visibility because of their controversial nature, because they address a theater-wide concern, or because they represent a major departure from current doctrine may be brought to the Engineer School by your chain of command during the ENFORCE Conference or the Council of Colonels meeting.

(see Sappers, page 69)

Photo courtesy U.S. Army Engineer School History Office.

THE U.S. ARMY ENGINEER SCHOOL

By Dr. Larry Roberts

As with the Corps of Engineers, the Engineer School traces its roots to the American Revolution. General Headquarters Orders, Valley Force, dated 9 June 1778, read, "Three captains and nine lieutenants are wanted to officer the Company of Sappers. As the Corps will be a school of engineering, it opens a prospect to such gentlemen as enter it...." Shortly after the publishing of the order, the "school" moved to the river fortifications at West Point, New York. With the end of the war and the mustering out of the Army, the school closed. However, the Regiment of Artillerists and Engineers was constituted as a military school and was reopened at the same location in 1794. For four years it constituted a school of application for new engineers and artillerists. Closing in 1798, due to a fire that destroyed many facilities, the engineers were without a school for three years.

In 1801, the War Department revived the school, and Major Jonathan Williams became its superintendent. Less than a year later, Congress authorized the Corps of Engineers and constituted it at West Point as a Military Academy. For the next 64 years, the Academy was under the supervision of the Corps. Although the curriculum was heavily laced with engineering subjects, the Academy commissioned officers into all branches of the service. Following the Civil War, supervision of the Academy passed to the War Department.

When the Engineer Battalion took station at Willetts Point, New York (see photo above), in 1866, engineer leaders saw the opportunity to develop a school oriented exclusively to engineers. From 1868 to 1885, an informal School of Application existed. Part of this effort involved the creation of the Essayons Club, an informal group that met during the winter months and presented professional engineer papers. In 1885, the School of Application received formal recognition by the War Department. In 1890, the name was changed to United States Engineer School.

In 1901, the school moved from Willetts Point (later called Fort Totten) to Washington Barracks in Washington, D.C., and was renamed the Engineer School of Application. Ironically, this name lasted only a few years. In 1904, the name was changed back to Engineer School. The school remained at Washington Barracks for the next 19 years, although it closed from time to time because of a shortage of officers or national emergencies.

In 1909, certain courses associated with the field army moved to Fort Leavenworth, and the Army Field Engineer School opened in 1910. That school, a part of the Army Service Schools, closed in 1916. The First World War forced a closing of the Engineer School because the instructors and students were needed to officer the expanding engineer force. The school resumed its instruction in 1920 but at a different location. Washington Barracks was transferred to the General Staff College, and the Engineer School moved to Camp A.A. Humphreys, south of Mount Vernon, Virginia. This was a World War I camp built on land acquired by the War Department in 1912. The original name for the tract was Belvoir.

For 68 years, Fort Belvoir was the home of the Engineer School. It produced thousands of officers, NCOs, and enlisted engineers who saw action in World War II, Korea, and Vietnam. Thousands more passed through the Engineer School during the peacetime years. In 1988, the Engineer School and Center moved to Fort Leonard Wood, Missouri. Here the traditions of engineering schooling, begun in the snows of Valley Forge, continue.

Dr. Roberts is the U.S. Army Engineer School historian at Fort Leonard Wood, Missouri.

Engineer School Commandants

Willetts Point, New York (Fort Totten)

MAJ James C. Duane	1865 - 1868
MAJ H. L. Abbot	1868 - 1886
MAJ C. B. Comstock	1886 - 1887
MAJ W. R. King	1887 - 1895
MAJ W. T. Rossell	1895 - 1895
MAJ J. G. D. Knight	1895 - 1901

Washington Barracks, D.C.

MAJ W. M. Black	1901 - 1903
MAJ Edward Burr	1903 - 1906
MAJ E. E. Winslow	1906 - 1907
MAJ W. C. Langfitt	1907 - 1910
MAJ W. J. Barden	1910 - 1913
MAJ Joseph E. Kuhn	1913 - 1914
MAJ William. P. Wooten	1914 - 1916
MAJ G. R. Lukesh	1916 - 1916
MG M. M. Patrick	1916 - 1917
COL W. W. Harts	1917 - 1917
BG Henrey Jervey	1917 - 1917
COL F. V. Abbot	1917 - 1918
COL Richard Park	1918 - 1918
BG Charles W. Kutz	1918 - 1918
COL Jay J. Morrow	1919 - 1919

Camp Humphreys, Virginia (redesignated Fort Belvoir in 1935)

MG C. A. F. Flagler	1919 - 1920
BG W. D. Connor	1920 - 1920
COL Meriweather L. Walker	1920 - 1921
MG Mason M. Patrick	1921 - 1921
COL J. A. Woodruff	1921 - 1924
COL H. Burgess	1924 - 1924
COL Sherwood A. Cheney	1924 - 1925
COL Edward M. Markham	1925 - 1929
COL Edward H. Schulz	1929 - 1933
COL George R. Spaulding	1933 - 1935
COL Laurence V. Frazier	1935 - 1936
COL Julian L. Schley	1936 - 1936
COL J. A. O'Connor	1937 - 1938
COL Thomas M. Robins	1938 - 1939
COL J. A. O'Connor	1939 - 1940
BG Roscoe C. Crawford	1940 - 1943
COL Xenephon H. Price	1943 - 1944
BG Gordon R. Young	1944 - 1944
BG Dwight F. Johns	1944 - 1945
BG Patrick Henry Timothy	1945 - 1946
COL Willis E. Teale	1946 - 1947
MG William M. Hoge	1947 - 1948
MG Douglas L. Weart	1948 - 1951
MG Stanley L. Scott	1951 - 1954
MG A. W. Pence	1954 - 1954
MG Louis W. Prentiss	1954 - 1956
MG David H. Tulley	1956 - 1958
MG Gerald E. Galloway	1958 - 1960
MG Walter K. Wilson	1960 - 1961
MG Stephen R. Hammer	1961 - 1962
MG Laurence L. Lincoln	1963 - 1965
MG Frederick J. Clarke	1965 - 1966
MG Robert F. Seedlock	1966 - 1967
MG Arthur W. Oberbeck	1968 - 1968
MG George H. Walker	1968 - 1969
MG William C. Gribble Jr.	1969 - 1970
MG Robert R. Ploger	1970 - 1973
MG Harold R. Parfitt	1973 - 1975
MG James A. Johnson	1975 - 1977
MG James L. Kelley	1977 - 1980
MG Maxwell W. Noah	1980 - 1982
MG James N. Ellis	1982 - 1984
MG Robert S. Kem	1984 - 1987
MG William H. Reno	1987 - 1988

Fort Leonard Wood, Missouri

MG Daniel R. Schroeder	1988 - 1991
MG Daniel W. Christman	1991 - 1993
MG Joe N. Ballard	1993 - 1995
MG Clair F. Gill	1995 - 1997
MG Robert B. Flowers	1997 - 2000
MG Anders B. Aadland	2000 - Present

PERSCOM Notes

Non-Branch-Qualified-Captain Assignments

By Captain Ronnie B. Griffin

The assignment of our non-branch-qualified (NBQ) captains is very critical to the future readiness of the Engineer Regiment. The objective in assigning NBQ captains is to ensure that each officer is exposed to the full spectrum of engineer assignments which will provide a broad range of experience in preparation for future responsibilities. Each officer must understand the process of an assignment action and the variables that influence the decision. I will focus on assigning officers from the Captain's Career Course (CCC) and discuss initiatives under consideration to improve the assignment process.

Our NBQ captains are assigned from the CCC to major Army commands (MACOMs) based on the unit readiness of subordinate units, the number of officers required by the Officer Distribution Plan (ODP), and when the officer can report to the command. The ODP is the personnel-management directive that determines the number of officers each MACOM receives based on the available population of officers in the Engineer Regiment.

Developing Assignments

Before we assign any officer from the CCC, we conduct a detailed analysis of each MACOM by reviewing the current number of officers on hand and the known and projected losses and actual gains that impact the command. Each officer in the MACOM is reviewed so that we have the most current information pertaining to his situation and how long he will be on station.

Once we complete this analysis, we determine the number of assignments to the MACOM by comparing the projected number of officers on hand versus the ODP for the time period that we are assigning officers from the CCC. The MACOMs that are projected to fall below the ODP are filled to the ODP first, by unit priority.

We allocate the total number of officers attending the CCC throughout the MACOMs based on the analysis and the preferences submitted. After preparing the assignment slate, we send it to the Officer Distribution Division (ODD), Personnel Command (PERSCOM), for approval. The ODD oversees the personnel accounts of the MACOMs and ensures that they are filled with the required number of officers based on the ODP. We work with the account managers to ensure that each MACOM is filled to the ODP. If it is not, we justify why and state when it will be filled.

Determining an Assignment

After slating is approved, we consider the variables that impact the assignments: personal preferences (potential duty locations and military schools), overseas tour equity, exceptional-family-member-program (EFMP) concerns, professional-development needs, joint domiciles (JD), and others. (Attending the University of Missouri's graduate-degree programs at Rolla or St Louis will not impact the assignment you receive.) During our time with the ODD account managers, we have usually worked out issues pertaining to EFMP and JD.

The first assignments we fill are those overseas because of unit readiness and tour equity. Korea is first, then Europe, Hawaii, Alaska, and other overseas areas. This ensures that all officers receive the same consideration for an overseas tour. Officers returning from an overseas tour to the CCC are not considered for a reassignment overseas unless they volunteer.

Next we fill the stateside locations by priority of fill with officers returning from short tours and all remaining officers in the CCC. Contributing factors that determine who is assigned where are current skills (primarily airborne and ranger), EFMPs, JDs, professional-development needs, and personal preferences. In each CCC class, about 65 percent of the officers request Fort Lewis, Washington; Fort Carson, Colorado; or Hawaii as their top three assignment choices. Obviously, there are more officers requesting these assignments than there are positions. The majority of officers assigned to those locations arrive there after a short tour and then request a sequential assignment to that location. So, if there is a particular location that you want, serve a short tour to Korea after the CCC and request a sequential assignment. This allows you to determine when to go overseas and complete a tour early enough when family issues may be less critical or a branch-qualifying assignment isn't critical to your career development.

The critical variable that impacts an assignment is professional-development needs. We want you to experience the full spectrum of engineer operations. Therefore, to broaden your professional development, we generally do not return officers to a duty station where they have already served. If you have a light engineer background, plan for your next assignment to be to a post that offers mechanized or combat-heavy engineer experiences. If you have mechanized experience, your next assignment (if qualified) could be to a post that offers light or combat-heavy engineer experiences. Having officers with diverse backgrounds ensures that the Regiment will have a qualified pool of officers available to meet the demands of tomorrow's Army.

Personnel Management Initiatives

We are studying several initiatives that will better inform officers of assignments, provide a wider array of career opportunities, reduce personnel turnover, and provide stability for our officers and their families. We are reviewing the possibility of assigning officers to the CCC a year in advance upon release of the captain's promotion list. This will allow the leaders in the field to manage their personnel better. Consequently, we can ensure that the MACOMs will have the required number of officers on hand at all times. We will assign the older year groups to the CCC before assigning officers from the promotion list. Officers will still be required to accept or decline the CCC within 30 days of a request for orders being published according

Operational Career Components

0 1 2 ⬆ 3 4 5 6 7 8 9 ⬆ 10 11 12 13 14 15 ⬆ 16 17 18 19 20 ⬆ 21 22 23 24 25

First and Second Lieutenants		Functional-Area Designation **Captain** Career-Field Designation		**Major**		**Lieutenant Colonel**		**Colonel**
Officer Basic Course	Troops	Engineer Captain's Career Course Combined-Arms and Services Staff School Company Command	Company-Grade Branch-Qualification Requirements	Command Staff College	Major Branch-Qualification Requirements	Battalion-Level Field-Grade Branch-Qualification Requirements	Senior Service College	Brigade-Level Command Utilization

Professional Development

Engineer Officer Basic Course/ Engineer Captain's Career Course/ Combined-Arms and Services Staff School	1
Lieutenant Time	3
Company Branch Qualification	2
Command Staff College	1
Field-Grade Branch Qualification	2
Battalion Command	2
Senior Service College	1
Brigade Command	2
Total years	14

Branch-Qualified Requirements

Active Component/Reserve Component
U.S. Military Academy
Army Staff
U.S. Army Recruiting Command
Joint
Advanced Civil School
Reserve Officer Training Corps
Observer/Controller
Department of Public Works
Functional Area
U.S. Army Corps of Engineers
Small-Group Instruction
Branch Immaterial

⬆ = Primary-Zone Promotion Board

This chart is based on information in Figure 16-1, DA Pam 600-3.

to Army Regulation (AR) 350-100, *Officer Active Duty Service Obligations*; AR 635-100, *Officer Personnel*; or AR 635-120, *Officer Resignations and Discharges*.

We work to ensure that officers assigned to Korea receive their station of choice upon return, but are reviewing the option of providing station of choice assignments for NBQ CPTs who volunteer for the 12-month tour to Korea before attending the CCC. Once officers are first lieutenant promotable, they will be able to request the one-year tour to Korea, serve the tour, attend the CCC, and proceed to their station of choice. This would be an opportunity to complete an overseas tour, gain valuable engineer experience, and get a station of choice.

We have started scheduling permanent-change-of-station (PCS) moves for the summer months, where possible, which allows families to plan around the school year. The CCC follow-on assignments are exempt from this initiative.

The personnel community is studying the impact of leaving officers on station for the duration of their tours instead of PCSing them immediately after completing their branch-qualifying position. Also being discussed is making Korea a 24-month accompanied tour.

Stay tuned for more information!

Your Obligations

For your benefit, ensure that your contact information (home and duty phone numbers and e-mail and home addresses) is up to date with your assignment officer. Ensure that you have a current photo on file at PERSCOM. Various senior leaders review your file for a variety of reasons (consideration for aide-de-camp, branch selection boards, and other nominative assignments). Many officers have lost an opportunity to make a favorable impression by not having an updated photo in their file.

Contact your assignment officer from time to time. Inform us when you arrive at a duty location and, most importantly, let us know when you take company command. After 6 months of command, give us a call and we can begin to address—with you and your chain of command—follow-on branch-qualified captain assignments. For officers considering advanced civil schooling options, it is best to take your graduate record examination before taking company command. You may not have time during command.

Familiarize yourself with Department of the Army Pamphlet (DA Pam) 600-3, *Commissioned Officer Development and Career Management*. It's your bible to career success. It contains information on leader development, career timeline, education, functional areas, and career-field designation. We receive numerous inquiries concerning these subjects.

Our NBQ captains are critical to the success of engineer units today, and all leaders must ensure that these officers are trained and ready to lead our Regiment tomorrow. We are committed to giving every consideration to assigning the right officer, with the right skills, to the right unit, at the right time.

Captain Griffin is the branch-qualified-captain assignments officer, Engineer Branch, Personnel Command (PERSCOM). Previous assignments include future-readiness officer, Engineer Branch, PERSCOM; observer-controller trainer, 2d Training Support Battalion (Engineer), 15th Support Brigade; company commander, 58th Transportation Battalion, 1st Engineer Brigade; S3 and assistant S3, 46th Engineer Battalion, Warrior Brigade; company executive officer, 84th Engineer Company, 2d Armored Cavalry Regiment; platoon leader, 102d Engineer Company, 199th Separate Infantry Brigade. CPT Griffin is a graduate of the U.S. Army Officer Candidate School and is pursuing a graduate degree from Webster University.

CTC Notes

Battle Command Training Program (BCTP)

2000 BCTP Perceptions for Mobility/Survivability

By Lieutenant Colonel Scott Bickell

Each year, the BCTP consolidates significant lessons learned as a result of Warfighter exercises. Developed for each Battlefield Operating System (BOS), these lessons learned become *BCTP Perceptions*. Two of three BCTP Perceptions for 2000 for the mobility/survivability (M/S) BOS—**Commanders and staffs do not take adequate actions to counteract enemy countermobility efforts** and **Commanders do not maximize countermobility capabilities or effects**—are carryovers from the 1999 BCTP Perceptions (see the November 1999 issue of *Engineer*). The third BCTP Perception focuses on deliberate river-crossing operations. In several Warfighter exercises, commanders and staffs have struggled with planning and executing deliberate river-crossing operations. It is apparent that these operations have become a lost art. The following perceptions address the problems that we have identified during Warfighter exercises and lists some tactics, techniques, and procedures (TTP).

Perception: Commanders and staffs do not plan or synchronize river-crossing operations.

Discussion: Commanders and staffs at the corps and division levels struggle with planning and executing deliberate river-crossing operations. This perception has three components:

- Staffs do not identify, and units do not set, the conditions to conduct river-crossing operations. There is no single doctrinal source that clearly articulates all conditions units must meet to conduct a river crossing. Typically, staffs will state the conditions that must be met, but they do not conduct a cross-BOS analysis of these conditions and do not develop plans that allow the necessary conditions to be met. Also, staffs do not clearly identify GO/NO-GO criteria for the river crossing based on meeting the conditions, nor do they develop contingencies that address the failure to set the conditions. Typically, a division will identify a set of conditions that must be met to conduct a successful river crossing. Often, subordinate brigades will identify a set of conditions to be met for the crossing, but these conditions are not linked to the division's conditions. Seldom is the status of these conditions briefed at battle-update briefs (BUBs).
- Commanders and primary staff officers tend to view river crossings as an engineer operation instead of a complex combined-arms operation. Units seldom plan a river-crossing operation as a combined-arms operation using all of the available staff expertise. Past Warfighter exercises have shown that engineers will have the "rose pinned on them" for developing the corps or division river-crossing plan. The staff engineer produces the written river-crossing plan and includes it as an appendix to the engineer annex. Cross-BOS analysis is seldom conducted, and details of the river crossing are not nested in the base order. Also, brigade-level staffs fail to conduct detailed river-crossing planning based on the division's plan and fail to adjust these plans based on current enemy and friendly situations.
- Units assign river-crossing operations to subordinate units and do not provide the required support. Corps and divisions typically task subordinate units to conduct river-crossing operations without giving them sufficient resources and support. Corps must allocate sufficient resources to crossing divisions. (Not every division needs to conduct an opposed river crossing; therefore, not every division needs river-crossing assets.) Divisions, like corps, must allocate sufficient resources and support to crossing brigades. Typically, divisions will allocate assets down to the crossing brigades. What is supposed to be a division deliberate crossing turns into separate brigade crossings that are not synchronized with the division's plan. Corps and divisions have a planning and resourcing responsibility for river-crossing operations. For instance, corps will develop the deception plan and resource this plan for a division's deliberate river crossing. Corps and divisions must also assist in setting the conditions for subordinate units' river-crossing operations. An example of this would be the corps providing additional artillery and aviation assets to conduct deep attacks against enemy artillery which could influence the crossing sites.

TTP:

- Units conducting a deliberate river-crossing operation must conduct a cross-BOS analysis of conditions to be met and must clearly identify GO/NO-GO criteria for the operation based on those conditions. The stated conditions should be nested in the corps/division base operations order, and the status of these conditions should be briefed at BUBs.
- Units must develop and execute detailed, synchronized plans that allow the necessary conditions to be met and develop contingencies that address the failure to set those conditions. Also, conditions set by subordinate units must be nested with those set by the higher headquarters.
- River crossings are complex combined-arms operations. Engineers provide the means and support to corps and division river crossings, but they should not develop the entire river-crossing plan. BOS integration and synchronization are key to planning and executing successful river-crossing operations. Units must plan river-

crossing operations as a combined-arms operation. Maneuver planners at the division level must take the lead on developing the deliberate river-crossing plan.

- A river-crossing operation should be included as part of the combined-arms rehearsal. Units that conduct detailed river-crossing rehearsals are generally more successful than units that do not.

In addition to these TTP, the following are recommendations for training in deliberate river-crossing operations:

- Conduct combined-arms battle-staff training at brigade and division levels which focuses on planning and executing a deliberate river-crossing operation. Include the use of simulations, such as Joint Army/Navy Uniform Simulation (JANUS) or Corps Battle Simulation (CBS), during this training.
- Plan and conduct a deliberate river-crossing operation at the home station if a waterway and assets are available. If an assault float-bridge company or multirole bridge company is not located at your post, coordinate with the Reserve Component. Over 70 percent of our bridge assets are in the Army National Guard or U.S. Army Reserve, and they would be more than willing to participate in an active division's deliberate river-crossing operation.
- From a BCTP standpoint, include river-crossing operations in the trend-reversal process and include focused rotation on river-crossing operations in future Warfighter exercises.

Conclusion

Planning and executing deliberate river-crossing operations have become a lost art. Few units have the opportunity to conduct a deliberate river-crossing operation as part of their home-station training. This is due in part to the loss of the divisional assault float-bridge companies. The engineer community must impress upon maneuver commanders that a deliberate river crossing is a complex combined-arms operation; it takes the entire combined-arms team to plan and execute a successful river-crossing operation. The Infantry and Armor Centers should act as the lead in deliberate river-crossing operations, while the Engineer, Artillery, and Chemical Schools should assist in future doctrine development.

LTC Bickell is the mobility/survivability BOS chief for BCTP Operations Group Bravo at Fort Leavenworth, Kansas. Before this assignment, he served as the assistant division engineer (ADE), 4th Infantry Division, and S3, 588th Engineer Battalion, 4th Infantry Division. LTC Bickell has also served in various command and staff positions in divisional and corps combat-engineer battalions.

Attention Units!

Many post offices will not deliver mail without a street address. Please contact us to update your mailing address if the one we are using for you does not include a street address. Include the old address and your telephone number, as well as the corrected address, and e-mail to *morganj@wood.army.mil.*

(Sappers, continued from page 63)

Junior leaders, do not sit on your ideas. Do not become cynical of procedures or embittered by slow progress. Take the words of the MANSCEN Commander Major General Anders B. Aadland, to heart: "Think through problems and let me know what you would do it YOU were the CG. DON'T COMPLAIN."[9] Use your senior leaders to convey your thoughts. Win their support by being detailed, thorough, and constructive in your analysis, and they will make your cause their own. Army time is a valuable commodity, and finding time to work issues outside of our daily jobs seems all but impossible. I believe, however, that developing the future of the Engineer Regiment should and must be a part of our daily routine, regardless of where we work. The Engineer Regiment, through the Engineer School, is transforming the way engineers will do business in the years ahead, and it is doing this admirably. We must also do our part because our thoughts and ideas will help give substance and shape to the somewhat nebulous future.

As Lieutenant General Ballard said at ENFORCE 2000, with regard to the future of the Engineer Regiment, "We must act collectively . . . become more adaptable. . . and become more flexible."[10]Let us work the issues as our Army transforms into this lightweight, technologically superior, and lethal powerhouse. Let us tell our soldiers that we care about their welfare and want to increase their survivability on this increasingly complex battlefield of the future so they can return home safely to their families. Let us question our TTP; assess our training aids, devices, simulators, and simulations (TADSS); and evaluate our equipment to see if they suit our future operating needs. Let us implement the means and the ways to train our engineers, making them better experts so we can win! If we can't, then at least "Let us try!" Essayons!

Captain Taphorn is a platoon trainer for the Engineer Officer Basic Course, B Company, 554th Engineer Battalion, Fort Leonard Wood, Missouri. Former assignments include platoon leader, C Company, 326th Engineer Battalion, and executive officer, HHT, 2-17th Cavalry Squadron, Fort Campbell, Kentucky.

Endnotes:

[1] ENFORCE 2000 Conference notes, May 2000.

[2] Ibid.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Brigadier General (Retired) Huba Wass de Czege and Major Jacob D. Biever, "Six Compelling Ideas on the Road to a Future Army," *ARMY*, Vol. 51, No.2, February 2001, pp. 43-46.

[7] TRADOC Pamphlet 525-5, *Force XXI Operations*, (part of front material, no page number).

[8] Lieutenant General Joe N. Ballard, "One Regiment, One Fight," *Engineer*, Vol. 29, April 1999, pp. 9-11.

[9] MANSCEN CG Philosphy.

[10] ENFORCE 2000 notes.

ENGINEER UPDATE

Commercial numbers are (573) 596-0131, ext. xxxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

MC-1 Tester. Several months ago, an e-mail message was sent to units that may have a horizontal construction mission requiring the use of the MC-1 Tester (NSN 6635-01-030-6896). The message contained important safety/legal information regarding the MC-1. If your unit has such a mission and did not receive the message, please contact this office.

POC is SFC Brian J. Nering, 37593; DSN -7593; or e-mail *neringb@wood.army.mil.*

WANTED! Warrant Officer Applicants. We need qualified MOS 81Ts, E5 or above, with 4 to 12 years of service time, to apply for the MOS 215D Terrain Analysis Technician Warrant Officer Program. The duty description is in Department of the Army Pamphlet 611-21, *Military Occupation Classification and Structure.* For information on how to become a warrant officer, go to the Warrant Officer Career Center's home page at *http://leav-www.army.mil/wocc/.*

POC is CW4 Frederick Kerber, 34088; DSN -4088; or e-mail *kerberf@wood.army.mil.*

Increased Enlistment Contract for MOS 51M Firefighter. Initial term retention for this MOS is well below the Army average, leaving this MOS with a reduced E5 population. Effective FY02, the 51M enlistment contract will be 5 years.

POC is SFC Jorge Rios, 37311; DSN -7311; or e-mail *riosj@wood.army.mil.*

Engineer Manuals and Mission Training Plans (MTPs) on the General Dennis J. Reimer Library. Not all engineer materials have been posted to the Reimer Library. If the publication you need has not been posted, contact this office. For a list of engineer manuals on the General Dennis J. Reimer Library, go to *www.adtdl.army.mil/atdls.htm* and click on "Enter the Library." Select "Field Manuals" on the left drop-down menu and "Engineer" on the right drop-down menu. Click "Submit." For a list of MTPs, go to the same Web site and enter the library but select "Mission Training Plans" and then the desired MTP.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762; or e-mail *snodgrar@wood.army.mil.*

Engineer Lessons Learned. We are getting a trickle of articles and have one SOP from field units. These new items can be found on the Center for Engineer Lessons Learned page of the Engineer School Web site. Please continue to forward any engineer lessons learned from exercises and operations; others may well benefit from your experiences.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762; or e-mail *snodgrar@wood.army.mil.*

Professional Engineer (PE) License. The Engineering Division of the Department of Instruction continues to serve as the Engineer School POC for soldiers who are seeking information about obtaining their PE license. To assist anyone interested in this subject, we maintain a Web page (*www.wood.army.mil/ENGR/register.htm*) that provides general information about registering military personnel and Department of Defense civilian employees as PEs.

POC is Mr. Kenny Light, 35655; DSN -5655; or e-mail *lightk@wood.army.mil.*

Terrain Visualization II CD-ROM. The Terrain Visualization II CD-ROM is now complete. Copies were mailed to the combat training centers; active, Reserve, and National Guard battalions; selected higher headquarters; other branch schools; and various agencies.

POC is MAJ Chris Kramer, 37060; DSN -7060; or e-mail *kramerc@wood.army.mil*

Situational Obstacle Training Support Plan (TSP). For some time, the combat training centers (CTCs) have reported situational-obstacle planning as a negative trend. To help reverse that trend, we have developed a Situational Obstacle TSP. In addition to augmenting instruction for the Engineer Officer Basic Course and the Engineer Captain's Career Course, we anticipate that this TSP will help reinforce planning at the unit level. The TSP was sent to the CTCs, engineer brigades, divisional engineer sections, and engineer groups.

POC is CPT Dan Smith, 35582; DSN -5582; or e-mail *smithda@wood.army.mil.*

Lesson Plans; Tactics, Techniques, and Procedures; and Other Products. The Tactics Web page is continually growing. We currently have a number of products available, including the Situational Obstacle TSP, planning aid for combat engineers, obstacle planning calculators, and an assistant brigade engineer battlebook. Also, links to the Terrain Visualization Center and the new Terrain Visualization II Multimedia Tutorial are on the Web site. These are located at *http://www.wood.army.mil/Tact/products.htm.* A slide show on the Engineer Captain's Career Course can be downloaded and used for officer professional development/NCO development program classes from *http://www-lab.wood.army.mil/student_handout/Engr/EOAC/MOD%20D-Engineer%20Tactics.*

POC is MAJ Michael Kinard or Mr. Ed Zielonka, 35592/37061; DSN -5592/7061; or e-mail *kinardm@wood.army.mil or zielonke@wood.army.mil.*

Mobile Training Teams (MTTs). Two mine-awareness MTT courses are available: one is for all arms and the other is engineer-specific. We recommend mine-awareness training within 3 months of deployment. Since our calendar is filling up, please contact us as soon as possible so we can schedule the training. Units are required to pay associated costs.

POC is Major Mark Griffin, 34134; DSN -4134; or e-mail *griffinma@wood.army.mil.*

Training Aids. We can help you procure mine-identification boards and individual plastic mines for your unit mine-awareness training. We have some of these items on hand and can connect you with suppliers.

POC is Mr. Mike White, 35578; DSN -5578; or e-mail *whitemi@wood.army.mil.*

Training Circular (TC) 3-34.489, *The Soldier and the Environment.* This publication is scheduled for release 3QFY01. It provides information on personal and professional responsibilities for protecting the environment. Information in the TC will help soldiers make responsible decisions about the environment. It is the companion to FM 3-100.4, *Environmental Considerations in Military Operations* (June 2000).

POC is MAJ John Whitfield, 35647; DSN -5647; or e-mail *whitfiej@wood.army.mil.*

Environmental Web Sites. The Office of the Director of Environmental Programs' home page *(www.hqda.army.mil/acsimweb/env)* is an excellent site for "communication and information between major Army commands." The site is also an unclassified information source for all parties interested in the Army's Compliance Program. The U.S. Army Environmental Center (USAEC) home page *(http://aec.army.mil)* is another excellent site for critical information pertaining to environmental compliance. The USAEC provides technical services to HQDA, major Army commands, and commanders and also integrates, coordinates, and oversees implementation of the Army's environmental programs for Army staff.

POC is MAJ John Whitfield, 35647; DSN -5647; or e-mail *whitfiej@wood.army.mil.*

Engineer-Focused Battle Staff Training System (EFBSTS). In late CY00, the Engineer School's self-paced, Internet-based, constructive training program for engineer staff officers and NCOs was approved as an Army Correspondence Course Program course. Four of the courses have been added to the Reimer Digital Library, with the remainder to be added during the next few months. The completed courses, including the new final exam, are available at *http://www.adtdl.army.mil/atdls.htm.* The remaining courses are still available through Mr. Skinner.

POC is Mr. Bobby Skinner, 36243; DSN -6243; or e-mail *skinnerb@wood.army.mil.*

Volcano Trainers. A reloadable Volcano training canister is being developed by the program manager and will be fielded to support CTCs and home-station training. This canister will reduce the overall cost of training on the ground- and air-delivered Volcanos. It will be able to deploy the new mine-effect simulator (VMES), which is being developed to replace the current mine-effect simulator for use at the CTCs, or a single "dog-bone" slug. The VMES will provide the means to deploy a realistic Volcano minefield. It is currently in Phase I, which is scheduled for completion at the end of September 01. Fielding dates and reload costs are not known at this time. The VMES, with its improvements, will—

- Function with the CTC instrumentation system.
- Fire one time only until reset.
- Contain replaceable batteries (2 AA).
- Have a locator buzzer activated by the controller "gun" to aid in recovery.
- Be deployed by Volcano using the reloadable canister or emplaced by hand.
- Be tested for a minimum of 50 deployments.

POC is Mr. Joe Decker, 34146; DSN -4146; or e-mail *deckerj@wood.army.mil.*

Directorate of Training Development (DOTD)

Field Manual Update. The following field manuals (FMs) have recently been sent to ATSC for printing and distribution. Look for them on the Reimer Digital Library at *http://155.217.58.58/atdls.htm.*

- Change 2 to FM 3-34.2, *Combined-Arms Breaching Operations.* This 3-page change corrects a figure depicting the fragmentation zone for firing the mine-clearing line charge (MICLIC). (The forward and rearward dimensions were reversed.)
- Change 1 to FM 5-34, *Engineer Field Data.* This change corrects some misinformation on bridging, mines, and obstacle symbols.

- Change 1 to FM 5-125, *Rigging Techniques, Procedures, and Applications*. This change institutes several technical revisions to bring the manual within American National Standards Institute standards. It technically outlines the wear conditions at which wire rope must be discarded as unserviceable. The changes deal with normal wear, birdcages, kinks, popped cores, and electrical damage. Drum-wire operations are addressed, as well as new figures for rope lay, wedge socket, basket-socket end fittings, and attaching basket sockets by pouring.

  POC is Sandra Gibson, 37651; DSN -7651; or e-mail *gibsons@wood.army.mil*.

Directorate of Combat Developments (DCD)

M172A1 Series 25-Ton Semitrailer. We need to know the condition of all M172A1 semitrailers in engineer units. The M172A1s were manufactured between 1973 and 1975 and have a useful life expectancy of 30 years. Currently, the Army has 879 excess M172A1s, so programming funds to replace the M172A1s until the excess trailers are disposed of may be difficult. We recommend that units that have local direct-support maintenance activities or a Directorate of Logistics conduct a 100 percent technical inspection (TI) and complete a cost repair sheet (ECOD) for each M172A1. If a trailer exceeds the military-expenditure limit, code it out so excess trailers can be distributed. Send copies of your TIs to: MANSCEN DCD, Engineer Division, ATTN: SFC Pezzuti, 320 MANSCEN Loop, Suite 141, Fort Leonard Wood, MO 65473-8929. We will forward these results to the Combined Arms Support Command (CASCOM) DCD for appropriate action.

POC is SFC Scott Pezzuti, 37357; DSN -7357; or e-mail *pezzutis@wood.army.mil*.

Mine-Awareness /Mine-Detection Equipment. There is a technology upgrade available for the AN/PSS-12 mine detectors that will improve soldier survivability and detection effectiveness, especially in metallic and/or mineralized soils. The upgrade is available as a modification work order (MWO). We are working to get funding from the Army Materiel Command (AMC) for the MWO application, which would then be done at the local installation level. We request that unit commanders who have the AN/PSS-12 in their mission-essential task list provide a statement of concern/statement of need to us immediately, identifying the requirement for better capabilities in mine-detection equipment because of the high risk to soldiers in difficult detection situations. These statements will be forwarded to AMC to justify funds to upgrade the AN/PSS-12.

POC is Mr. Glenn Boxley, 37337; DSN -7337; or e-mail *boxleyg@wood.army.mil*.

TRADOC Program Integration Office-Terrain Data (TPIO-TD)

TerraBase II 5.0. The 5.0 version provides access to new data types and significant new capabilities for TerraBase II users. The following are some of the new features:

- Users can display and query the National Imagery and Mapping Agency (NIMA) vector-product-format (VPF) data such as foundation feature data (FFD), Mission-Specific Data Sets (MSDS), vector maps (VMAP) and vector interim terrain data (VITD).
- Users can display VPF data with the prototype GeoSym 4.0 CGM map symbology.

NOTE: The GeoSym 4.0 Prototype is not complete. GeoSym CGM scripts will only work on Windows NT and Windows 2000 systems. Symbol functionality is product-specific; not all symbols will display on all products. MicroDEM will display only those symbols which have complete CGM scripts that function correctly with Windows API calls; most line symbols do not meet this requirement. GeoSym is not a final working product. Implementing a fully functional CGM map-symbol overlay depends on the changes that are made to the future GeoSym 5.0 and future releases of MicroDEM.

- NIMA digital terrain-elevation data (DTED), controlled-image base (CIB), and compressed arc digitized raster graphics (CADRG) data can now be loaded to the hard drive and accessed concurrently using the new NIMA database function.
- Users can create their own ESRI shape files and database attribute tables while performing heads-up digitizing on screen.
- New military-icon and map-icon functions allow placement of scaled, Military Standard 2525B symbols and nonscaled, user-selected graphics on map overlays.
- The OpenGL 3-D View allows real-time control and display of map and imagery data draped over elevation data.
- The new route-observation "Ambush" movies allow clear and concise views of potential friendly/enemy gun positions along a route.

- Users can create true 3-D map and perspective views of terrain using stereo-anaglyph functions. Viewing requires red-blue filter glasses.
- The built-in Pipeline Automated Planning Aid (PAPA) allows logistics planners to define a route for installation of a pipeline. PAPA will then calculate the profile; pressure heads; pump placement; and number of sets, kits, and outfits required for the project.
- CastleNET users can graphically display and query the obstacle database.
- The United States Geological Survey's (USGS's) digital-elevation-model data can now be exported in NIMA DTED format.
- New dual universal-transverse-mercator (UTM) grid displays, dual Military Grid Reference System (MGRS) and latitude/longitude coordinate displays, and roaming of pointer position on all displays simplify the instruction; understanding; and use of datums, grids, and coordinates for new and experienced users.
- Products created in version 5.0 can now be exported directly to PowerPoint presentations with a single mouse click.

TerraBase II version 3.0, 4.0, and 5.0 software and training materials can be downloaded free from the Terrain Visualization Center Web site at *http://www.wood.army.mil/TVC/.*

POC is LTC Steve Tupper, 34077; DSN -4077; or e-mail *tuppers@wood.army.mil.*

News and Notes

National Engineers Week's *Future City* Competition. To increase public awareness and appreciation of the engineering profession and to help students better understand the practical applications of mathematical and scientific principles, the National Engineers Week Committee sponsors an annual competition. The Engineering Society sponsored the Michigan regional competition at the Spirit of Ford building in Dearborn, Michigan, on 30 January 2001. Twenty-six teams from schools throughout Michigan participated. The theme centered around future communications. Students designed their future city, plotted a map, built a scale model with a moving part, wrote an essay, and made oral presentations to panels of judges. Ideas for communications ranged from neural implants, to wrist communicators and holographic eyeglasses, to DNA implants. Each school can sponsor one team, consisting of three students, a teacher, and a mentor. St. John Lutheran School from Rochester won the regional event and an award from Ford Motor Company for "Best Transportation." The team went to the National Competition in Washington, D.C., during Engineers Week, 18 through 24 February, and received an award from the American Society of Civil Engineers for "Best Aesthetic Design in Structural Engineering" and an award from the Society of Manufacturing Engineers for "Best Manufacturing Zone." The national champion, St. Barnabas Catholic School from Chicago, Illinois, received a trip to the U.S. Space Camp in Huntsville, Alabama. Next year's materials will be available in mid-August. For more information on *Future City,* go to *http://www.futurecity.org*. For more information on Engineers Week, go to *http://www.eweek.org*.

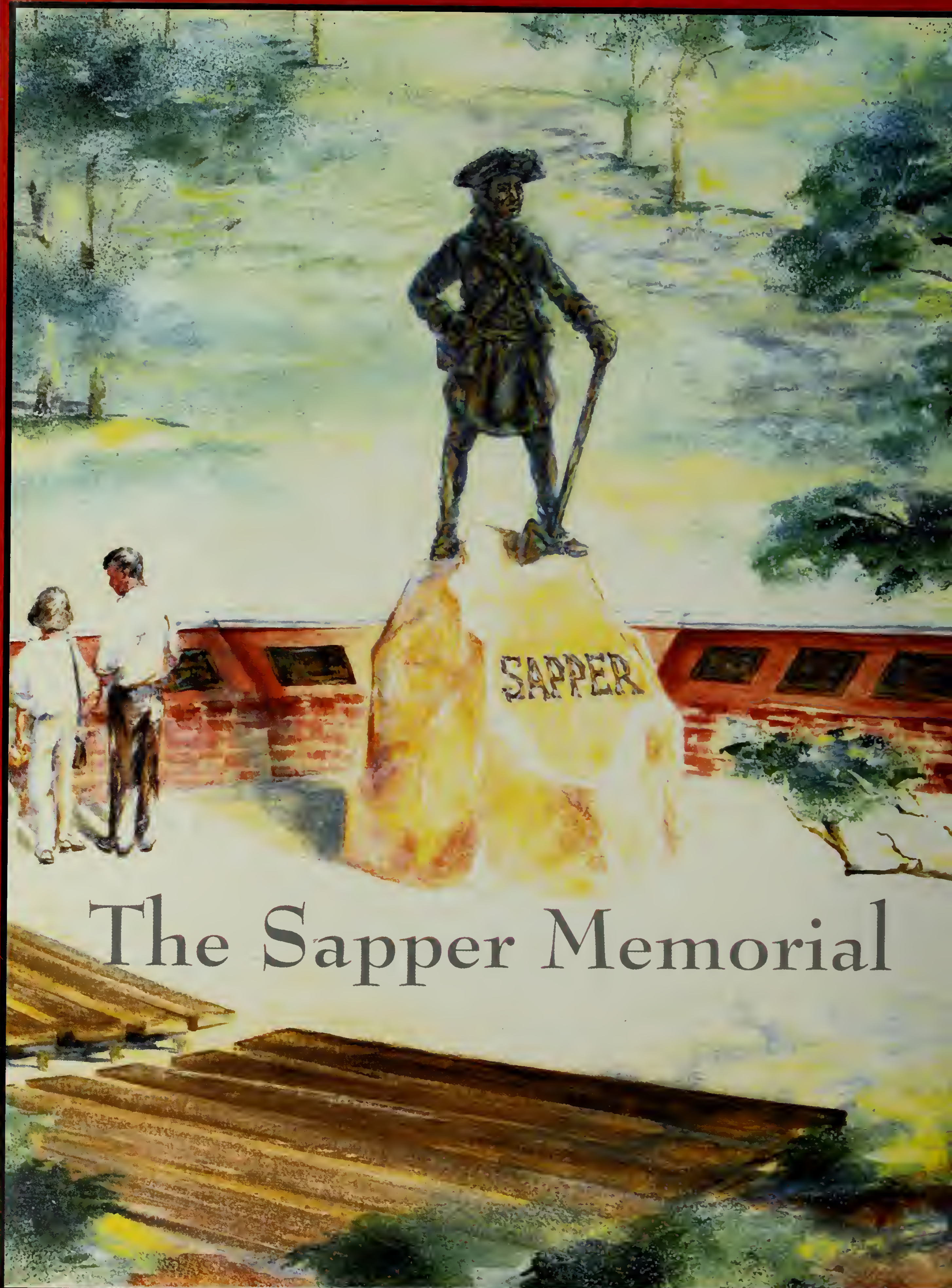
POC is Patrick T. Klever, (616) 842-5510, or e-mail *Patrick.T.Klever@lre02.usace.army.mil.*

Balkans Special Collection. The History Department at the United States Military Academy is collecting materials for a Balkans Special Collection that will be maintained in the West Point Archives. The intent for this collection is to consolidate materials that will be helpful to those interested in the soldier's experience in the Balkans. The collection would make future research on service in the Balkans easier and prevent the loss of a wealth of soldier experience and insight as time passes and individuals discard invaluable materials. The collection will include any electronic or hard-copy information that soldiers have maintained concerning their experiences while serving in the Balkans during the last several years. These materials can either be correspondence kept from the period of deployment (letters home, to friends, or the home unit; journal entries; and e-mails) or recollections of time spent in the Balkans (including personal reminisces and formal after-action reviews). If you have any materials you think will interest the Academy's History Department or if you wish to contact the department, use the information below:

Mr. Alan C. Aimone, Senior Special Collections Librarian, U.S. Military Academy Library, West Point, N.Y. 10996-1799
Phone: (845) 938-2954, fax: (845) 938-3753, or e-mail: *ua3925@exmail.usma.mil*

POC is CPT Jeffrey French, (845) 938-4410, or e-mail *kj6911@trotter.usma.edu.*

BACK COVER:
An artist's rendering by Joan Ozment shows the Engineer Memorial Grove, which will commemorate the history and lineage of the Sapper Engineer. The statue portrays a Sapper from the Revolutionary War. During ENFORCE 2001, a groundbreaking ceremony will be held for the park, which will be located adjacent to the Engineer Museum.



The Sapper Memorial

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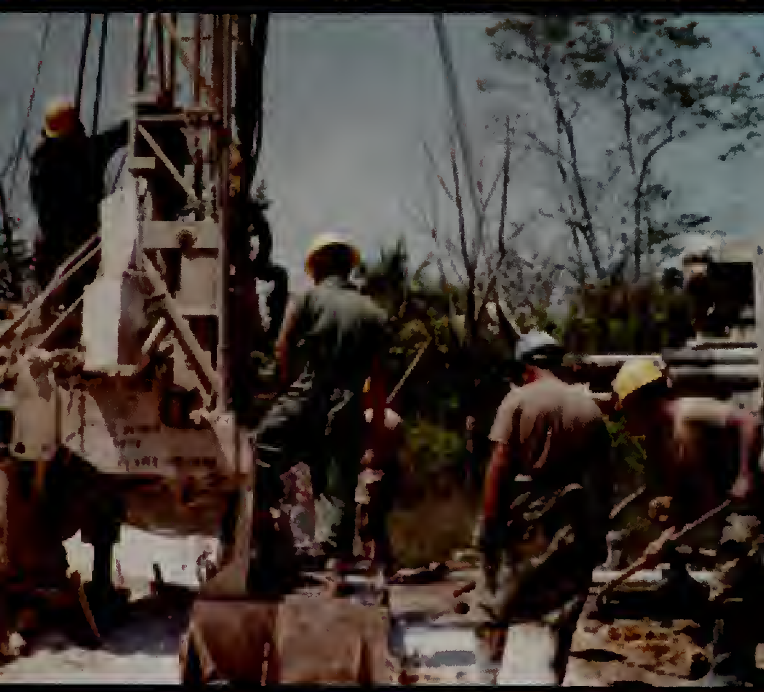

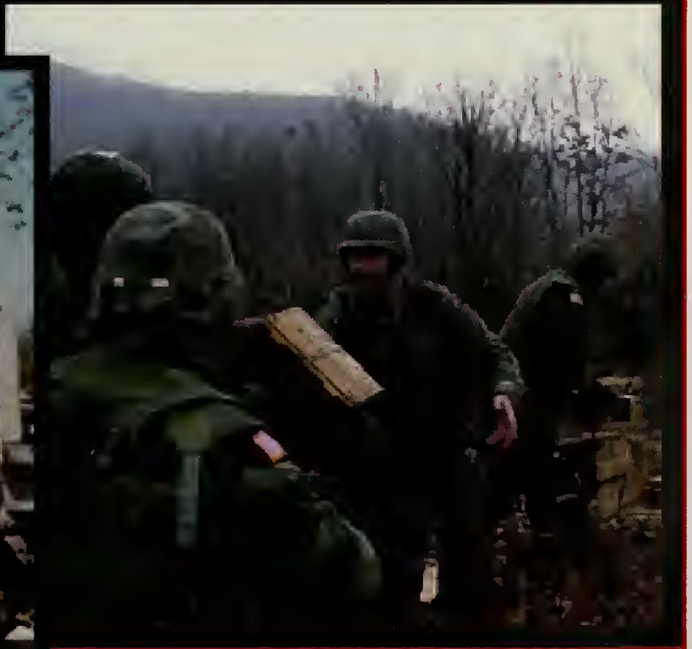

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***Front Cover:** The diversity of U.S. Army engineers can be seen in these photos: (from top) ENFORCE color guard; soldiers from the 425th Engineer Detachment develop a well in Guatemala; a soldier passes a case of C4 explosives to another soldier at the Class V supply point in preparation for a cave demolition in Kosovo.*

***Back Cover:** A skid-mounted well-drilling machine being used by engineers in England, with a 4-ton truck in the background. 25 April 1944.*

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Clear The Way

By Major General Anders B. Aadland
Commandant, U.S. Army Engineer School

The euphoria of a successful ENFORCE 2001 has still not worn off. The professional interaction with the great leaders from all walks of the Regiment reassures us that we are ready to embrace change, work as a team to achieve Army Transformation, and do whatever is necessary to support this great Army. Thanks to each and every participant (Active, Reserve, retired military, civilian, and contractor) for making ENFORCE 2001 such a professionally rewarding experience. We're also grateful to all the guest speakers who enriched our knowledge, challenged our paradigms, and stimulated our ability to see beyond current systems, technologies, and problems.

Among them, the Honorable Dr. Joseph Westphal, Acting Secretary of the Army, made a special farewell appearance to thank us for our support to the nation. U.S. Representative Ike Skelton expressed his pride in the ongoing training program at Fort Leonard Wood and the importance of the Army Engineers to the history of the nation and our Army. He committed his support to provide the Army with the resources it requires to stay strong and healthy. LTG (R) Max Noah was honored by the Regiment as the 2001 Gold de Fleury recipient and MG(R) Jack Waggoner was installed as the new Honorary Colonel of the Regiment. We thank these distinguished gentlemen for their great support to our Regiment and Army.

Our Regiment bids a special thank-you and farewell to two of our great leaders, warriors and friends—Major Generals Phil Anderson and Milt Hunter—as they retire from our ranks this summer. We look forward to their continued mentorship, now from a different segment of our network. Godspeed, Phil and Milt.

Let's not lose the ENFORCE 2001 momentum. As our examination of the Transformation issues revealed, we have much to do. This bulletin contains a follow-up to many issues we addressed during ENFORCE 2001, including a short report that summarizes the essence of the breakout sessions. Let's make sure that we captured all the key perspectives from the field and answered your questions. If you have additional comments concerning any of the breakout topic areas, please get them to us ASAP. It is essential that we continue to work each of these issues as paramount to the Transformation of the Corps's people, units, systems, concepts, and doctrine.

As you look over this bulletin, consider the immense diversity of our branch. Being an Army Engineer, a sapper, is not a boring, single-mission kind of occupation; take great pride in that. Just a few examples play out in this bulletin. Think of it: We perform combat-engineering tasks such as providing mobility, countermobility and survivability to the maneuver force; construct roads, ports, and airfields; build and improve the nation's infrastructure; drill wells and run pipelines; analyze and shape the world's terrain; provide disaster relief; and create power where none exists. As leaders in the Corps, we must continue to seek out and educate ourselves on what the Regiment's soldiers, civilians, and contractors can do. Ask yourselves—

- What can a well-drilling detachment do for me? What are the capabilities, organization, or resource requirements? How do I get them?
- What lessons can we learn from the 44th Engineer Battalion's and the 82d Engineer Company's Imjin River exercise?
- What changes to school- or unit-taught demolition tasks did the 16th Engineer Battalion sappers make to complete their cave demolition mission?
- How can we better integrate the Reserve Component with the Active Component? Take a look at the article from the 224th Engineer Battalion, Iowa Army National Guard, and see if you can apply that knowledge.
- Where should we be using simulations as a means to train Army Engineers? As we pursue our vast array of training missions, simulation becomes the tool of choice on an ever-expanding scale. However, we face many limitations in current systems that we are rapidly working to overcome. CW2 Mohn's article provides a discussion on real terrain effects versus the simulation of terrain effects within the Corps Battle Simulation (CBS) database. We still need to do more work to narrow the gap between reality and simulation effects for engineer units, capabilities, mines/obstacles, river-crossing operations, and other engineer missions within simulation models. This is worthy of your study and thoughtful consideration.

As we continue to ride the wave of change in our Army, we should look closely at the changes ongoing within the Engineer School and MANSCEN. This issue signals that time when transition is at its peak. Just to name a few of our outgoing heavy hitters, we bid farewell and thanks to: BG Ron Johnson, Assistant Commandant; COL Doug Hom, Deputy Assistant Commandant; COL Bill Pierce, TPIO-Terrain Data; COL Jim Rowan, Director of Training; COL Lou Best, Commander, 1st Engineer Brigade; COL Chuck Moldenhauer, Deputy Director, Maneuver Support Battle Lab; LTC Billy Tollison, USAES Chief of Staff; and LTC Harry Rossander, Doctrine Chief. We also extend a hearty "welcome aboard" to the inbound talent who now take over the following key positions: BG Randy Castro, Assistant Commandant; COL Pat Leake, Deputy Assistant Commandant; COL Bob Kirsch, Director of Environmental Integration; COL Jim Rowan, Commander, Ist Engineer Brigade; COL Dave Kingston, TPIO-Terrain Data; LTC(P) Jeff LaMoe, Director of Training; LTC Jeff Bedey, Department of Instruction; and LTC Tom Chapman, USAES Chief of Staff; LTC Bill Duddleston, Doctrine Chief. These are your new schoolhouse warriors. Add them to your list of key leaders in the Regiment—call on them, use them, embrace them, and talk to them about how we need to improve across DTLOMS as a combat arms member of the combined arms team.

Essayons!

Lead The Way

By Command Sergeant Major Robert R. Robinson
U.S. Army Engineer School

I want to start by thanking all of you, the leaders of our Regiment, for making this year's ENFORCE conference such a success. Your presence at our annual conference provides the information and insights we need to shape the Regiment and keep us viable during the Army's transformation process.

I thank all the command sergeants major/sergeants major (CSMs)/(SGMs) of the Active and Reserve Components for their assistance in resolving several issues and for their candid and open perspectives on how we ought to do business as engineers. I think the interaction between the CSMs/SGMs, the briefings from the Engineer Commands' (412/416) SGMs, and the updates from the sergeants major and the Engineer Branches and our own Engineer Personnel Proponency Office gave us a better indication of just how diverse we are and on the health of the Regiment.

I sincerely appreciate your involvement in the dinner we hosted for CSM Lugo. Your presence there, tokens of appreciation, and words of praise meant a lot to him and was, in my opinion, a great way to honor a soldier who has given much to our Army.

The Sergeant Major of the Army (SMA) was tentatively scheduled to visit Fort Leonard Wood during our ENFORCE conference, but he was called to testify before Congress. Instead, he visited Fort Leonard Wood from 22 to 24 May. During that visit, we were able to showcase some of the Engineer School, 1st Brigade, and engineer soldiers. He spent over 3 hours talking to engineer soldiers—permanent party and trainee—received a briefing on the Sapper Leader Course, and visited the "Million Dollar Hole" (TA 244) where he operated the deployable universal combat earthmover (DEUCE) and was given an overview and tour of the Engineer Equipment Maintainer's Course. Although a very short and condensed trip, he went away with a better understanding of what we do at Fort Leonard Wood for our Regiment. In a trip report to his boss, General Shinseki, the SMA reported that the soldiers and leaders of Fort Leonard Wood were well disciplined and enthusiastic about their duties. He also reported that the installation, as a whole, exuded a quality of life and an environment consistent with the highest Army ideals. That is a great report and testament of our soldiers at Fort Leonard Wood.

During the first week and a half of June, I visited our Engineer soldiers and units in Germany. Up front, I will say that things have changed dramatically since my departure some 20 years ago. My first stop was in Heidelberg, where I spent the evening with many of United States Army, Europe's, engineers at their annual Engineer Ball. Headquarters, Deputy Chief of Staff, Engineers, sponsored this year's event in the Heidelberg Castle—what more appropriate place could there be than a castle to gather engineers and celebrate their Regiment and its accomplishments.

The next day I was off to Giessen to visit the soldiers of the 16th Engineer Battalion, 1st Armored Division. There I spoke with the soldiers and noncommissioned officers (NCOs) of the 16th Engineer Battalion and watched first-hand as soldiers performed maintenance on their vehicles and equipment. Those soldiers were doing a great job and were completely engaged in the movement of the engineer brigade headquarters back to its old home in Giessen.

From there I went to Bamberg and visited with soldiers of the 82d and 9th Engineer Battalions. Upon arriving, I flew to the Combat Maneuver Training Center and watched soldiers from the 9th participate in lanes training with their brigade combat team. I sat in on an after-action review and listened to sappers address and overcome the challenges of being an integral part of a maneuver force. The next day I ate breakfast with soldiers from the 82d Engineer Battalion, had lunch with senior NCOs of the 1st Infantry Division Engineer Brigade, and finished the day in a professional development session (NCOPD) with NCOs of the engineer brigade. The soldiers in the 1st Infantry Division are tremendous and live and work in a great community where the emphasis on quality of life is evident.

I spent the last two days of my trip with soldiers of the 130th Engineer Brigade, whose headquarters is in Hanau. The brigade CSM, however, wanted me to start my visit in Vilsek, visiting the soldiers of the 54th and 94th Engineer Battalions. The 54th was in the middle of executing some of the best field training I have seen, conducting live-fire exercises as part of an event-driven scenario. The 94th was in the midst of recovery from a recent trip downrange and was hosting a training-management-review brief to the V Corp commander. I was completely taken off guard when I saw that the battalion headquarters was in the middle of the motor pool. What a novel idea and a great way to stay focused on one of the bigger challenges in our Regiment—MAINTENANCE. The following day, I went to Hanau and made my way through the motor pools of the 502d and 38th Bridge Companies and visited the different kasernes in the area. Although I was assured that the unit insignia worn by the soldiers of this great brigade DID NOT mean "We Work Weekends," this unit was hard at it during my stay there in Europe.

Bottom line is that I had the opportunity to see about a third of the Regiment's engineers doing what engineers traditionally do—performing superbly in support of our Army and our nation. The quality of life in Germany has changed dramatically. I couldn't help but be impressed by how the facilities, installations, and communities have improved, giving the soldiers who serve on the fringe of conflict the quality of life they deserve.

We have thousands of outstanding soldiers, leaders, NCOs, officers, and civilians who are giving impeccable support to the Army in Germany and superbly representing the Engineer Regiment. I am extremely proud of those soldiers and civilians for what they do on a daily basis, as I am of our entire Regiment for all that you do.

The 4th Annual CSM/SGM Fall Off Site Conference is scheduled for 24 to 28 September 2001, at Carlisle Barracks, Pennsylvania. Information concerning the conference is on the Engineer School Web site. I realize that these events—ENFORCE and the Off Site Conference—are difficult for many of our CSMs and SGMs to attend because of training calendars, resources, and home-station commitments as competing priorities. However, know that these are worthwhile events, important to the team building efforts of our Regiment. The Off Site Conference serves as professional development for the senior NCOs of our Regiment and helps to bridge the gap on important issues between ENFORCEs. Please support this upcoming event.

In closing I want to thank you all for the great service you provide to our Army and to the Regiment. I sincerely hope to visit the remaining units in our Regiment soon.

Engineers Lead The Way!

Military Water-Well Drilling

By Captain Tim Scarbrough and Captain Paula Lang

> ***"Water, water, everywhere, nor any drop to drink."***
> ***—Samuel Taylor Coleridge***

In recent years, especially since the attack of Hurricane Mitch on Central America, humanitarian civic operations have dramatically improved the quality of life for thousands of people in need. This aid came from international civic foundations, religious organizations, volunteers, and the U.S. armed forces. All four services use Active Component (AC) and Reserve Component (RC) service members to help refugees by constructing roads, schools, medical facilities, and housing and providing medical services and potable-water wells.

Well drilling is a viable, necessary engineer mission that provides potable-water sources for all combat, combat-support, and combat-service-support units, as well as civilians and humanitarian-support agencies. Although the Army, Navy, and Air Force all have well drillers, most of them are in the U.S. Army Reserve (USAR) and the Army National Guard (ARNG). The 28 well-drilling units in the U.S. armed forces are heavily employed in Europe, the Caribbean, Central America, and the United States, working closely with the U.S. Army Corps of Engineers (see table on page 8). To help explain the military well-drillers' world, this article addresses their roles, methods, and equipment; becoming a well driller; assignments; and issues and answers.

Well-Drilling Roles

According to U.S. Army Field Manual 5-484, *Multiservice Procedures for Well-Drilling Operations,* well-drilling detachments are combat-service-support assets that are usually at the corps or theater level. The units are tasked to supplement surface-water sources in two instances: when it is unnecessary or too costly to transport volumes of water or when groundwater wells are needed as a logistical backup in case of nuclear, biological, or chemical surface-water contamination by the threat. In addition to drilling wells, the units identify and compile data on surface-water sources, compile data using drilling logs and surveys for drilling-site identification, and restrict access to contaminated or dangerous well sites and seal the holes.

Well-Drilling Methods

Since a variety of geological formations—ranging from hard consolidated rock to soft unconsolidated sediments—may be encountered during well construction, several well-drilling methods have been developed. The most common methods are mud and air rotary drilling and down-hole hammer or percussion drilling.

Mud Rotary Drilling

This method uses a highly viscous "mud" to float the cuttings from the current drill depth to the top of the borehole. This fluid is recycled by using a series of catch sumps or mud pits and a pumping device to keep a constant flow down the drilling rod, up the hole, and out again. The mud—being based of clays, water, and other materials—also forms a filter-cake layer to provide a seal down the hole. This is the preferred method of well drilling for all the services.

Air Rotary Drilling

Similar to mud drilling, this method uses air instead of mud and is advantageous when it is inconvenient to use water for drilling. Air rotary drilling requires less time for well development but is more problematic due to its inability to support unstable geology and the frequent need to cool and lubricate the drill bit. This type of drilling requires a well-maintained compressor to produce the 3,000-feet-per-minute (fpm) minimum velocity to blow the cuttings up and out. A drilling foam may be used to enhance the air's ability to carry cuttings up and out.

Down-Hole Hammer or Percussion Drilling

This method involves crushing the teeth of the drill bit into the soil by impact. Pneumatic or compressed air is the delivery means to carry cuttings up and out. Used in extremely unfavorable conditions, such as extremely hard rock, this type of drilling is also used to drill shallow holes for loading explosives at quarries and other excavations.

Well-Drilling Equipment

The common, attainable well-drilling depth is 400 to 600 feet. A drilling system must be able to operate continuously to a 600-foot depth (threshold) or a 2,000-foot depth (objective). Geography and drilling history supports the need to go much deeper in desert regions in which groundwater levels are farther below the surface than in temperate regions. Mountainous terrain also requires a deeper drilling depth because groundwater only roughly follows topographic features, thereby making groundwater sources harder to reach. Temperate climates have a generally level topography and advantageous stratigraphies and are favorable for drilling wells less than 600 feet deep. Hilly terrain, arid climates, and poorer geology make it necessary to drill up to 1,500 feet to find water. Extremely arid areas, such as North or South Africa and Southwest Asia, typically require well depths from 1,640 feet to over 5,000 feet, depending on the water table and the degree of salinity.

The necessity of water sources, especially in desert conditions, mandates a system capable of long-term operation without failure. Drilling rigs must be equally functional despite frozen, temperate, or desert conditions because soldiers need water to survive and accomplish their assigned missions. When supporting humanitarian missions, especially following a natural disaster in which potable water is unavailable, both military and civilian personnel depend on these drilling rigs until the emergency ends or damaged utilities become operational.

Army

The current Army well-drilling and well-completion equipment consists of the 600-foot well-drilling system manufactured by the G.E. Failing Company (see Figure 1). It includes an LP-12 rotary well-drilling machine mounted on a Navistar 6 x 6 truck chassis, a support vehicle, and a lightweight well-completion kit that includes accessories, supplies, and tools. With the completion kit, a well can be drilled to a depth of 600 feet using mud, air, or a down-hole hammer with or without foam injection. With the addition of an auxiliary air compressor and a drill pipe, the 600-foot system can drill to depths of 1,500 feet and accommodate the 1,500-foot well-expansion kit. The drilling machine does not have to be modified when drilling with mud to 1,500 feet; however, additional equipment and more drill pipe are required to use the expansion kit.

Additional equipment with the LP-12 includes casing, elevators and slips, larger drill bits, and 900 feet of additional drill steel. This machine has a 32-foot mast, three-drum draw-works assembly, rotary table, mud pump, and an air compressor. The truck engine, through a power-take-off (PTO) subdrive, powers the components of the rig. A hydraulic system operates the leveling jacks, mast-raising cylinders, and breakout cylinders. The vehicle is also equipped with attachments to tie down and lift the vehicle during transport.

For United States Southern Command (SOUTHCOM) missions in Central America, air drilling is commonly used because of the volcanic geology. Mud drilling can fill cracks of deep geologic formations with the mud, causing a loss of pressure and a potential collapse of the hole. In extremely volcanic rock, little progress can be made with mud drilling. The current LP-12's air compressor cannot support air drilling because of its low pounds per square inch/cubic feet per minute (psi/cfm) (350 psi/1200 cfm), which is only adequate for mud drilling. It is also extremely difficult to deploy this equipment because minor to major disassembly is necessary to make it air transportable.

Air Force

Rapid engineer-deployable, heavy-operations repair squadron-engineer (RED HORSE) units have no organic

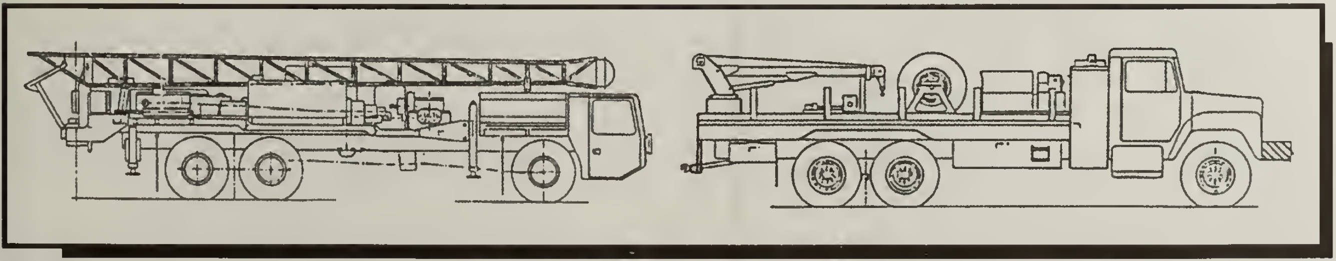


Figure 1. LP-12 well-drilling machine and support truck used by the Army

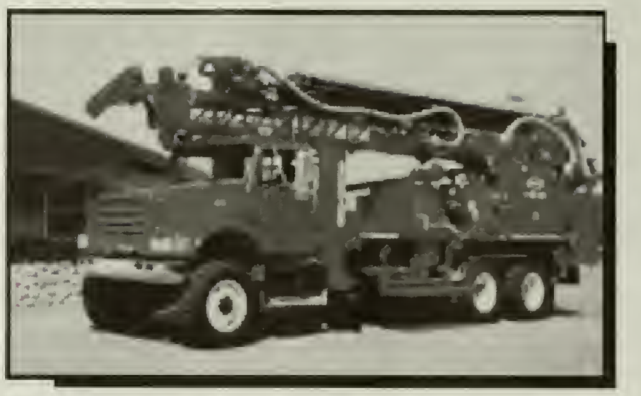


Figure 2. T450MII Rotadrill used by the Air Force

well-drilling equipment, so they commonly use rigs made by Schramm and Winter Reese. The Schramm T450MII Rotadrill is a top-head drive, truck-mounted drill rig engineered primarily for applications using combination mud rotary, air rotary, and down-hole hammer drilling methods (see Figure 2).

The truck engine provides reliable power for all hydraulic, mud, and air systems. Rugged top-head-drive rotation and efficient pipe handling mean high productivity on the job site and more time spent drilling. All functions are driven hydraulically by a PTO installed on the truck's engine, permitting a variety of mud pump, air, and accessory-system combinations. The T450MII is well suited for constructing water wells in unconsolidated formations, as well as monitoring well construction and environmental-drilling investigations using mud, air, and auger methods. One drawback to this machine is its size. Maneuverability and deployability are more of a problem because of the Schramm rig's length compared to rigs used by the Army and Navy. The Winter Reese rig is equally capable of drilling 1,500 feet, but it is scheduled to be replaced.

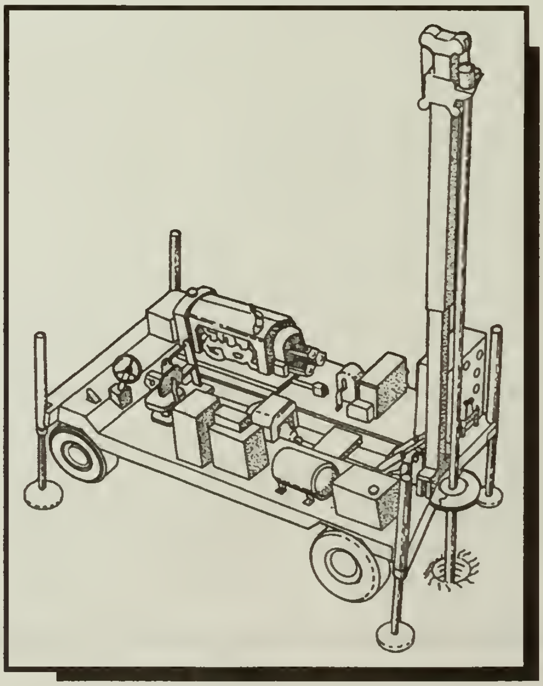


Figure 3. ITWD drill used by the Navy

Navy

The Navy's current well-drilling rig is the ITWD (ISO/Air Transportable Water-Well Drill) manufactured by Ingersoll-Rand (see Figure 3). The ITWD top-head drive rig is mounted on a 4 x 4 chassis and is capable of drilling up to 1,500 feet. It has 1,530 feet of drill steel along with 90 feet of collars as part of the collateral. The rig has no air compressor, but a down-hole hammer is included along with a 5 x 6 mud pump for mud drilling. The Navy has included a Sullair 750-cfm compressor as part of the well-drilling equipment. Common site problems exist, such as drilling below 1,000 feet. In addition, the rigs have a tendency to require rebuilding after less than 3,000 hours of operation. The ITWD's best feature is maneuverability. It is very portable and can fit into tight drilling sites due to its 19-foot 3-inch length.

Most well-drilling units deploy with electric- or hand-pump well-completion kits—an essential part of every well-drilling bill of materials (see Figure 4). The kits vary in size and capacity according to the well being drilled. In areas with an adequate power supply and a water-storage facility and/or delivery system, electric pumps are used. However, in rural areas with no electricity, such as in Central America, hand pumps are installed in wells.

Becoming a Well Driller

In the Army, well drillers are in a "low-density" military occupational specialty (MOS). They are construction-equipment operators (MOS 62J10) whose MOS training is

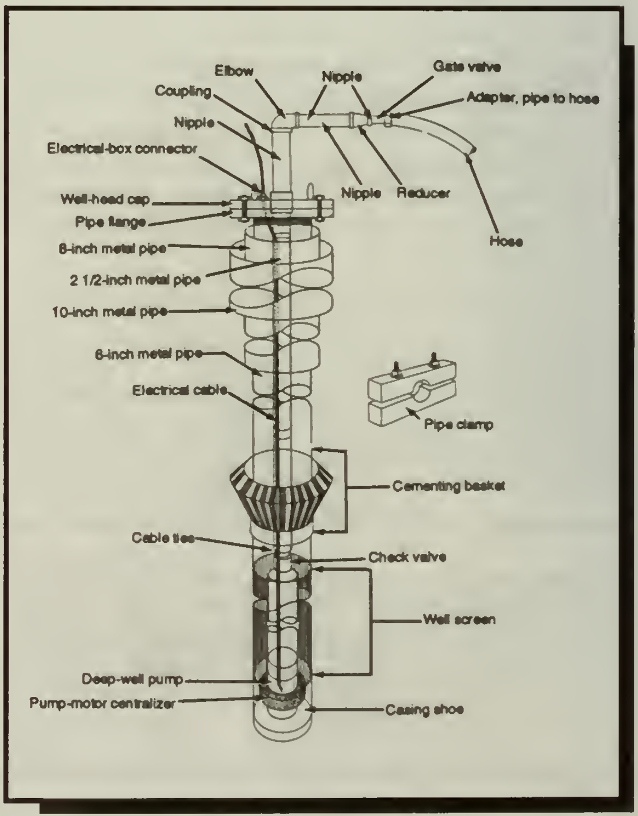


Figure 4. Standard electric well-completion kit

During the New Horizons 2000 exercise in Guatemala, soldiers from the 425th Engineer Detachment used the LP-12 drilling rig to set up the final well casing for a project in Panarama.

completed as advanced individual training (AIT) at the Maneuver Support Center, Fort Leonard Wood, Missouri.

The problem encountered in training well drillers is in acquiring the additional skill identifier (ASI). To be eligible to receive the ASI, a soldier must be an E-5 or E-4 (P) and complete the 6-week ASI C3 course. Although the course is very well-developed and qualitative, it does not train lower enlisted soldiers effectively because it is a leadership course, and soldiers graduating from AIT have only basic experience as leaders. Soldiers with more experience who reclassify into this MOS have fewer difficulties than new soldiers reporting from AIT.

The ASI C3 course consists of the following areas of study:

- General safety.
- Groundwater location.
- Geology.
- Drilling-equipment operation (most well-drilling rigs on the market).
- Well-drilling methods.
- Water-well design.
- Well development.
- Drilling terminology, charts, and tables.
- Troubleshooting methods.

Because the Navy is the proponent for water-well-drilling education for all three services, the ASI C3 course is taught at Port Hueneme, California, at the U.S. Naval Construction Training Center. There are no mobile training teams for RC soldiers at alternate locations.

Well-Drilling Assignments

Where are military well drillers going? The best answer is...*everywhere*! (See table on page 8.) Despite doctrinal policy stating that well drillers are a combat-service-support asset to corps or theater operations, these personnel are being used for installation and local-municipality support in CONUS and humanitarian aid OCONUS.

SOUTHCOM conducts an annual Nuevos Horizones (or New Horizons or NH) exercise, which provides valuable services to Central and South America and the Caribbean. During this exercise, soldiers from all four services not only receive important training but also provide much-needed end products—such as schools, clinics, latrines, roads, and wells—for the host nation. Military well drillers have been valuable assets to thousands, if not millions, of people in the SOUTHCOM area of responsibility.

Issues and Answers

In July 2000, staff officers from the 416th Engineer Command, Darien, Illinois, and the 439th Engineer Battalion, Bismarck, North Dakota, joined forces and hosted a well-drillers conference in Bismarck. The first of its kind, this conference was the start of a now widely distributed network of expertise and support from the Army, the Air Force, and the Navy. The ultimate goal of the conference was to bring to the forefront issues regarding personnel, training, and equipment.

Geologists and hydrogeologists from the U.S. Army Corps of Engineers Technical Engineering Center provided several excellent courses of study for drillers and their support personnel. In addition, valuable planning and advice was provided by the Maneuver Support Center, the U.S. Army Reserve Command, and the Naval Construction Training Center. As a result of the conference, and through help from the U.S. Army Engineer School, well drillers from all services now have online resources where they can study, share ideas, and ultimately bring themselves onto the theatre commander's radar screen as an invaluable asset. The Web site is *http://www.wood.army.mil/warrior/Well.htm*.

Water-Well-Drilling Units and Missions

Army

Drilling Detachments		Missions		
Unit/Location	Branch	Past	Present	Future
38th Engineer Detachment Fort Bragg, North Carolina	AC	Haiti; Panama; Fort Bliss, Texas; North Carolina	Guatemala	To be determined
247th Engineer Detachment New London, Connecticut	ARNG	Stones Ranch Military Reservation, Connecticut; Honduras	Stones Ranch Military Reservation, Connecticut	Nicaragua
257th Engineer Detachment Phoenix, Arizona	ARNG	Honduras	California	Nicaragua
269th Engineer Detachment Live Oak, Florida	ARNG	Camp Blanding, Florida	Camp Blanding, Florida	Camp Blanding, Florida
322d Engineer Detachment Kings Mills, Ohio	USAR	El Salvador; Fort Gordon, Georgia	Fort McCoy, Wisconsin	El Salvador
328th Engineer Detachment Montgomery, Alabama	USAR	Organized TY01	MOSQ, ASI C3; North Dakota	Belize
334th Engineer Detachment Montgomery, Alabama	USAR	Organized TY01	MOSQ, ASI C3; North Dakota	Belize
425th Engineer Detachment San Antonio, Texas	USAR	Pine Ridge Indian Reservation, South Dakota	Guatemala	El Salvador (tentative)
484th Engineer Detachment Montgomery, Alabama	USAR	Organized TY01	MOSQ, ASI C3; North Dakota	Belize
747th Engineer Detachment Missoula, Montana	USAR	Guatemala	Camp Grafton, North Dakota	ASI C3/ Central America (tentative)
775th Engineer Detachment Jackson, Tennessee	ARNG	Tennessee/California/ Kentucky; Honduras	Campo, California	Camp Shelby, Mississippi
916th Engineer Detachment Bismarck, North Dakota	USAR	Guatemala; El Salvador	Camp Grafton, North Dakota	ASI C3/ Central America (tentative)

Air Force

Drilling Detachments		Missions		
Unit/Location	Branch	Past	Present	Future
307th RED HORSE, Detachment 1 Barksdale AFB, Louisiana	AF-RC	El Salvador; Guatemala; Panama; Rosebud Indian Reservation, South Dakota; Haiti; Belize; Honduras; Texas	Gillis Long Facility, Carville, Louisiana	To be determined
307th RED HORSE Kelly AFB, Texas	AF-RC	El Salvador; Guatemala; Panama; Rosebud Indian Reservation, South Dakota; Haiti; Belize; Honduras; Texas	Gillis Long Facility, Carville, Louisiana	To be determined
819th RED HORSE Malmstrom AFB, Montana	AF-RC	Bolivia	Nebraska; Malmstrom Missile Field, Montana	Colorado
820th RED HORSE Nellis AFB, Nevada	AF-RC	Peru; Nicaragua; Korea; Belize; Nellis AFB Range	Guatemala; Nellis AFB Range	Europe; Nellis AFB Range
823d RED HORSE Hurlburt Field, Florida	AF-RC	El Salvador; Nicaragua; Panama; Haiti	Paraguay; Jamaica	El Salvador

Navy

Drilling Teams	Missions		
Unit/Location	Past	Present	Future
3d Naval Construction Battalion, 31st Naval Construction Regiment, Port Hueneme, California	Haiti; Jamaica; El Salvador; Thailand; Honduras; Crete	Sasebo; Japan; Indonesia; Bosnia; Jamaica	To be determined
2d Naval Construction Battalion, 20th Naval Construction Regiment, Gulfport, Mississippi	Souda Bay, Crete; Guatemala; Honduras, Jamaica	Bosnia	El Salvador

Soldiers from the 820th RED HORSE use a Navy ITWD drill at Porvenir, in Guatemala, during New Horizons 2000.

One issue discussed at the conference was the military's need for a new drilling rig that is self-contained and skid-mounted, with support and completion modules. The support or "tender" module should contain or transport all necessary tools, bits, pumps, casings, and drilling-support tools. The completion module should support mud, air, or percussion drilling, to include power-generation and air-compressor capacity for drilling 1,500 to1,800 feet. The separate major components should be portable, air transportable, and easily assembled or disassembled. When downloaded and assembled at a drilling site, the major components should be capable of completing or sealing a well without the need for external support. Drilling rigs produce wells despite sedimentary, metamorphic, and igneous rock. Casings and screens make it possible to produce well water despite loam, clay, and sandy soils. Currently, there is no command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) information-exchange requirement associated with well-drilling rigs.

A Valuable Asset

Well-drilling units are a valuable asset—both at home and abroad. To increase the value added of the engineer role as well drillers, leaders at all levels need to consider the following:

- Development of equipment supporting mobility constraints.
- Mobile training that supports the geographic dispersion of soldiers across the entire RC force.
- Lack of knowledge regarding bills of materials and geological data necessary for water-well drilling.

One Army engineer officer involved with well drilling in New Horizons 2001-Guatemala said about drillers: "The people in this region of the world can build structures well enough, but they cannot approach the long-term, quality-of-life improvement provided by U.S. military well drillers. In this area, as in most, water is life."

Captain Scarbrough is an active-duty project engineer for the 416th Engineer Command, Darien, Illinois. Previously the 416th's public affairs officer, he is the point of contact for issues on military water wells, alternative construction technology, theatre construction-management systems, and training management.

Captain Lang is an active-duty assistant S3 and well-drilling subject-matter expert for the 439th Engineer Battalion, Bismarck, North Dakota. Previously the 439th's S6 officer, she is also the point of contact for issues on military water wells.

References:

1. Field Manual 5-484, *Multiservice Procedures for Well-Drilling Operations,* 8 March 1994.

2. Charlie Brown, U.S. Army Corps of Engineers Mobile District.

3. Laura Waite, U.S. Army Corps of Engineers Mobile District.

4. Jim Smith, Maneuver Support Center, Fort Leonard Wood, Missouri, *ORD for Well Drilling ACAT IV*, dated 21 February 2001.

The MANSCEN Construct

By Mark T. Premont

Overview

The Maneuver Support Center (MANSCEN) has been officially activated since 1 October 1999, and the organizational design is proving to be a workable structure. The design is different from the typical U.S. Army Training and Doctrine Command (TRADOC) school organization because it not only places more than one school on the same installation, but those schools also share some organizational structure in a grid matrix management arrangement. This structure yields some unique opportunities and poses some interesting challenges. The dynamics of this restructuring will take years to fully unfold and develop, but the key characteristics are evident today. Like every new organizational structure, it is a work in progress. The structure is sound, in full operation, and learning new efficiencies every day. The organization is more complex in its conceptional form than many typical military organizations because the chain of command and the chain of responsibility are not aligned as simply as many tactical units. They are, however, set to provide the best capability with the least overhead.

The Genesis of MANSCEN

To understand MANSCEN, you must know how its organizational structure developed. The organization is the direct result of the Base Realignment and Closure (BRAC) Act of 1995. Through legislation, Congress approved the BRAC Commission's recommendation to close Fort McClellan, Alabama, and relocate the Chemical and Military Police (MP) Schools to Fort Leonard Wood, Missouri. Fort Leonard Wood was a somewhat typical TRADOC installation with one school—Engineer; a basic-training brigade; the Noncommissioned Officer Academy (NCOA) with the Drill Sergeant School (DSS); an advanced individual training course—Motor Transport Operator Course (driver's training)—from the Transportation School; affiliated courses for the Marines, Air Force, and Navy; several U.S. Army Forces Command units; and the usual support units that are typical on U.S. military installations.

Once the BRAC decision was official, serious discussion took place on how to organize once the Chemical and MP Schools moved to Fort Leonard Wood. The spectrum ranged from each of the three schools being totally independent with no shared resources to the full integration of the Chemical, Engineer, and MP schools into one large school, sharing all resources. The totally independent end of the spectrum was too costly in personnel. Even at Fort McClellan, the Chemical and MP Schools had shared one training brigade. The full integration end did not allow the schools to maintain and foster their own branch identity. Therefore, a careful study was made to determine which areas could be shared without significantly affecting the branch-identity aspect of school regimental operations. Another consideration was that each school's commandant was chartered as the proponent for his or her branch area of expertise. The new organization had to facilitate the commandants carrying out their proponent responsibilities. The decision was to create the organization as shown in the figure.

The Organization of MANSCEN

The commander of MANSCEN, a major general billet, is also the installation commander and the Engineer School Commandant. The Engineer brigadier general billet remained the Engineer School Assistant Commandant. Two traditional Reserve Component brigadier general billets were added to the MANSCEN command group, one for the Army Reserve and one for the Army National Guard. The MANSCEN Command Sergeant Major completes the command group.

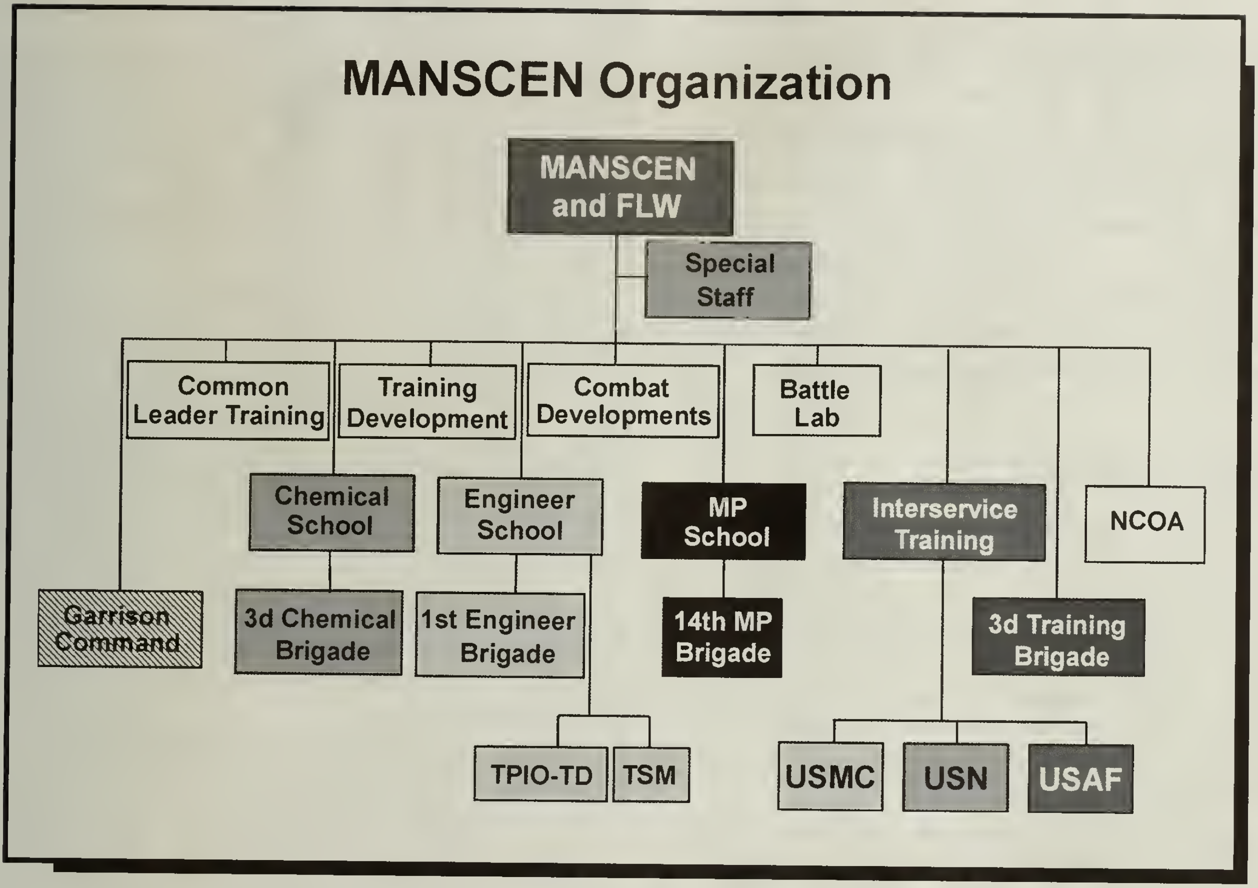
The MANSCEN staff organizations share responsibility with all three schools. Each of these organizations reports to the MANSCEN commander but has responsibilities to each of the school commandants for execution of its mission. The NCO Academy expanded to conduct the Noncommissioned Officer Education System for all three branches. Each school has its own training brigade. The interservice training presence increased; the Marine Corps presence grew to be the largest Marine Corps unit not on a Marine base, and the Air Force presence grew to be the largest Air Force unit not on an Air Force Base.

The Shared Organizations

Directorate of Common Leader Training (DCLT)

DCLT is responsible for MANSCEN-level instruction and instructional support. It—

- Teaches the common-core and shared tactical instruction to the officer and warrant officer professional development courses for the three schools.
- Operates the Single-Channel Ground-to-Air Radio System Communications Lab and the Fire Support Center as well as the Training Technology and Information Center.
- Manages the installation's library program, which includes the academic and community libraries.


MANSCEN Organization

- Conducts the Interservice Staff and Faculty Development Program, which certifies the instructors for the installation.
- Owns the Battle Simulation Center, which supports all constructive training simulations within MANSCEN and the Reserve Component, regionally.

Directorate of Training Development (DOTD)

DOTD develops training products and provides editorial support of doctrinal products for the three MANSCEN schools. It has four departments: Warrior, WARMOD, Warfighter, and Development Support.

- Warrior (Individual Training) develops and maintains the commandants' training strategies and provides analysis, design, and development of technically and doctrinally correct instructional courses and support materials for resident, nonresident, and distance-learning initiatives.
- WARMOD synchronizes and links Army modernization training with chemical, engineer, and MP force modernization. This includes ensuring development and procurement of system Training Support Packages concurrently with the materiel system.
- Warfighter (Collective Training) programs, manages, analyzes, and develops proponent unit/collective training products and training-support products; coordinates proponent Standards in Training Commission; and interfaces with internal and external organizations to ensure integration into the collective-training efforts for accuracy and completeness of products.
- Development Support provides technical and administrative services, support, and guidance on development of all MANSCEN and service schools' training and doctrinal products, including contractor-produced publications. It develops and assists other training developers with TRADOC-funded and contingency-based multimedia products—including instructors in their multimedia efforts—by assisting with embedded multimedia elements, to include recording and editing audio/video into various formats and delivery methods. This department also produces official publications and bulletins for worldwide distribution.

Directorate of Combat Developments (DCD)

DCD serves as the architect of the future for the MANSCEN schools. It—

- Integrates all combat-developments activities for the three schools not specifically assigned elsewhere. In this capacity, DCD develops operational concepts, validates operational-capability requirements, conducts the systemic analysis of requirements, and carries out all organizational development and force-design processes and materiel-development processes, including life-cycle management.
- Develops and defends modernization strategies and plans and integrates the budget process for the President's Objective Memorandum.

- Conducts modeling, simulations, and analysis for all MANSCEN organizations, including developing modeling and simulations requirements.
- Conducts ground-robotics test-bed activities to assess technology for the three schools.

Maneuver Support Battle Lab

The Battle Lab was the first shared organization formed in the stand-up of MANSCEN and is led by the MANSCEN commander. It tests and verifies, through experimentation, all aspects of doctrine, training, and organization for the three schools and works closely with DCD and DOTD in support of the schools.

Noncommissioned Officers Academy

This organization includes NCOA and DSS. The MANSCEN NCOA/DSS is the Army's largest NCO academy. It trains and educates selected NCOs to become effective leaders, trainers, role models, standard bearers, and drill sergeants. The academy is responsible for training soldiers for the three MANSCEN schools. Instruction includes basic and advanced NCO courses. The academy also trains a variety of different military occupational specialties (MOSs) in the Primary Leadership Development Course.

The DSS conducts a Drill Sergeant Preparation Course for all drill sergeant candidates assigned to Fort Leonard Wood, and it trains soldiers in a variety of MOSs to become drill sergeants. It also trains selected leaders, support cadre, and installation staff and contractors—who work in the initial-entry-training environment—in three different courses through its Initial Entry Cadre Training Course.

Summary

MANSCEN is still developing, but it has already demonstrated the power and efficiency that can be gained by integrating three related branches into one organization, each providing unique proponency capabilities, while sharing common ground across the doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS) spectrum. MANSCEN proves that a single installation can support three Army branch schools, maintain the vitality of each school, yet achieve synergy among them where common issues and concepts exist. This design could be a model for the way TRADOC will reorganize through its own transformation effort.

Mr. Premont is the executive officer in the Strategic Planning, Analysis and Realignment Office at Fort Leonard Wood, Missouri. Previously, he was the deputy director in the Base Realignment and Closure Office at Fort Leonard Wood. He has a bachelor's from the U. S. Military Academy and a master's from the University of Missouri-Rolla and is a graduate of the U.S. Army Command and General Staff College.

Today's Engineer School

By Brigadier General Ronald L. Johnson

Change has become a way of life with the Army, the training community, and your Engineer School. In 1989, the Engineer School moved to Fort Leonard Wood, Missouri; in 1995, we began planning to receive two other schools. On 1 October 1999, the Maneuver Support Center (MANSCEN) and Fort Leonard Wood replaced the Engineer Center and Fort Leonard Wood. However, amid these changes, we continue to contribute to the evolution occurring in the Army, seek to influence TRADOC's planning for transformation among the schools, and produce concepts and products for the Engineer Regiment.

With all these things going on, and the fact that we have now been operating under the MANSCEN umbrella for nearly 2 years, we believe it is time to pause and give you an overview of what we look like now and how we are going about doing your business—the business of the Engineer School.

Essentially, the processes by which we produce concepts, materiel, organizations, doctrine, training, and soldiers have not changed. Many of the same people who were working within the Engineer School 2 years ago continue working to produce the same types of engineer products. However, some of these people now work within MANSCEN directorates.

The Engineer School has benefited from MANSCEN in a number of ways. We have access to advanced classrooms and computer labs and new and improved training facilities. We have learned some new processes and business practices from the staff of the Military Police and Chemical Schools. We believe our influence as a Branch has not been diminished; MANSCEN can serve as an amplifier of the Engineer School's requirements.

Undoubtedly, for those of us who work here, communication and lines of authority are a bit more complex than when we were a "stand-alone" school. However, we aspire to keep those things invisible to you and provide the same quality and quantity of products as were produced when the Engineer School was the "only kid on the block." As is pointed out in the closing paragraph of the following article, we still have great engineer people doing the work of the Engineer Regiment.

Brigadier General Johnson, former Assistant Commandant, U.S. Army Engineer School, is now commander of the Pacific Ocean Division, U.S. Army Corps of Engineers, Fort Shafter, Hawaii.

How the Engineer School Runs

By Jim Evans

NOTE: Recommend that you read "The MANSCEN Construct," on page 10, before reading this article.

Overview

If you read the above noted article, you should understand that the U.S. Army Engineer School is not an autonomous entity. It falls under the U.S. Army Training and Doctrine Command (TRADOC) and the Maneuver Support Center (MANSCEN) umbrellas. Thus, the Engineer School must strive to satisfy the needs of the Engineer Regiment through the funding and administrative procedures that TRADOC provides. It must also conduct its activities and produce doctrine, training, leader, organization, materiel, and soldier (DTLOMS) developmental products by relying on a combination of its internal resources and the resources available through MANSCEN.

The MANSCEN commanding general provides command and control for the Chemical, Military Police (MP), and Engineer Schools and Fort Leonard Wood. (He is dual-hatted as the Engineer School commandant.) The school commandants have direct responsibility over their branch-specific DTLOMS functions. Creating MANSCEN consolidated many functions which were previously embedded within each of the three schools. However, doctrine development, branch-specific training, and branch-specific personnel development continue to reside within the schools.

Branch personnel responsible for much of the "heavy lifting" of developing systems, developing training, and designing organizations were consolidated into MANSCEN organizations, but each of the three schools retains the responsibility for providing strategic direction and the right to approve or disapprove branch-specific actions. Before the beginning of each fiscal year, the "heavy lifters" propose a laundry list of activities they believe should be accomplished the following fiscal year. The school leadership reviews, refines, and approves the list. As the year progresses, the leadership may direct a reordering of priorities.

Inside the Engineer School

The figure on page 14 is a visual representation of the school's organization. The school's mission is to develop, train, and support the engineer force to provide maneuver engineering, force-support engineering, and geospatial engineering to Army, joint, interagency, and combined operations.

Commandant

The commandant is the engineer proponent. Proponency includes the following:

- Providing quality engineer-specific training.
- Developing leaders qualified to ensure mission achievement.
- Designing engineer organizations consistent with the Army's needs.
- Identifying and articulating engineer materiel requirements.
- Ensuring the recruitment and retention of engineer soldiers of the quality and quantity required by the Engineer Branch.

Assistant Commandant (AC)

The AC directs the operation of the school and exercises command and general supervision over all elements—listed below—assigned or attached to the school:

- Branch Staff.
- Directorate of Training (DOT).
- 1st Engineer Brigade.
- TRADOC System Manager (TSM)–Engineer Combat Systems (ECS).
- TRADOC Program Integration Office–Terrain Data (TPIO-TD).
- Directorate of Environmental Integration (DOEI).

Command Sergeant Major (CSM)

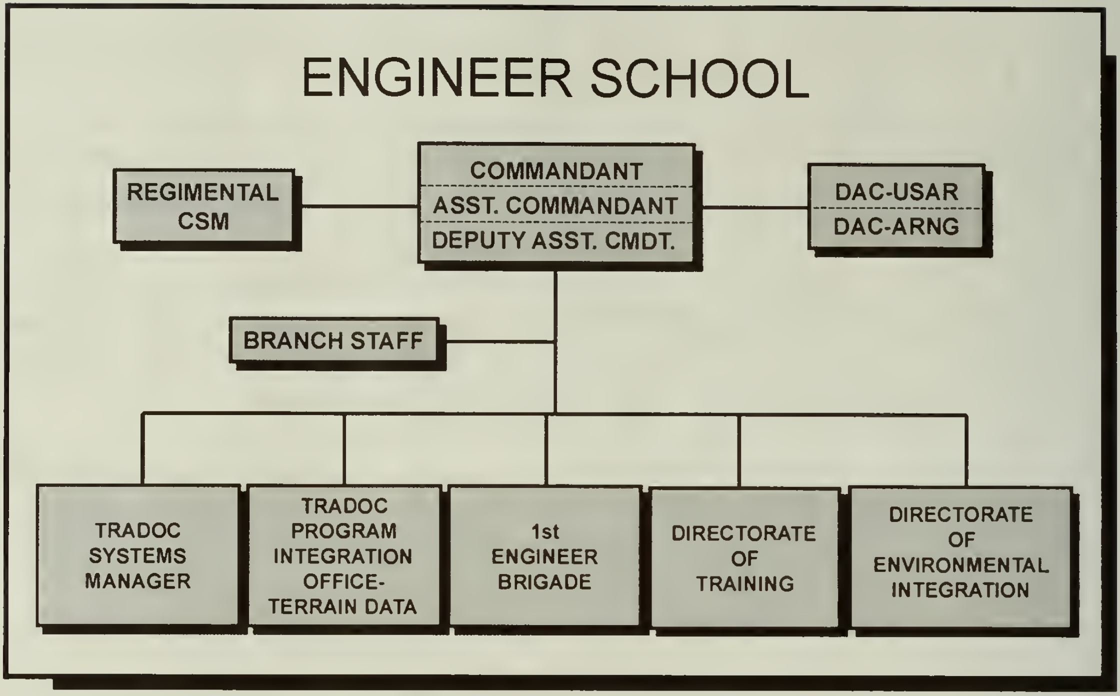
The school CSM is also the Regimental CSM. He serves as the principal enlisted assistant and advisor to the AC on all enlisted matters and manages the enlisted personnel within the school. He has direct oversight of engineer noncommissioned-officer (NCO) courses taught at the MANSCEN NCO Academy.

Deputy Assistant Commandant (DAC)

The DAC serves as the senior technical adviser to the commandant on engineer concepts, force structure, and materiel. He formulates policies, plans, and recommendations for administration of the Engineer School. He assists the AC and acts in the AC's absence.

Deputy Assistant Commandants—U.S. Army Reserve (USAR) and Army National Guard (ARNG)

The DAC-USAR and the DAC-ARNG oversee total-force integration. They ensure that Reserve Component (RC) needs are addressed by the schools and MANSCEN and participate in developing policies, plans, and programs influencing RC matters. They review engineer training and doctrinal materials for RC applicability and adequacy and assist in verifying training materials with RC units. They provide liaison among the Engineer School and TRADOC, the Combined Arms Center, the Chief of Army Reserves, the Army Reserve Personnel Center, the National Guard Bureau, the U.S. Army Reserve Command, the U.S. Forces Command, and RC units. They advise



active duty officers separating from service about RC programs and requirements, provide instruction on the roles and missions of the RC to classes conducted at the Engineer School, and advise Reserve students attending training.

DTLOMS Integration Board

This board provides oversight of the commandant's responsibilities as branch proponent. The board consists of the AC (chair); the DAC; the DAC-USAR; the DAC-ARNG; the Director of Training; the Commander, 1st Engineer Brigade; the TSM; the TPIO-TD; and the chief of the engineer division, Directorate of Combat Developments (DCD). The Engineer School chief of staff facilitates the board activities. The board—

- Integrates Regimental activities across DTLOMS.
- Provides leadership and guidance on—
    - Master training calendars for the Engineer School.
    - Engineer concepts.
    - Engineer doctrinal changes.
    - Priorities within the engineer 1-N list of equipment.
    - Major changes in training strategies.
    - Organizational changes.
    - Priorities within the Concept Examination Program, warfighting-lens analysis, and other processes.
    - Personnel-management policies.

Branch Staff

The chief of staff directs the actions of the branch staff and acts as executive officer for the AC. He provides taskings to entities inside and outside the school and acts as operations officer and G3 for the school. He monitors Engineer School resources and works in coordination with the Directorate of Resource Management to manage resources. His oversight includes the Operations Office, History Office, and Engineer Museum.

Operations Office. This office coordinates the school's administrative functions and advises the leadership on personnel, administrative, and policy matters. The staff serves as the school's interface with MANSCEN agencies, including the Public Affairs Office; the Directorate of Resource Management; the Directorate of Public Works; the Directorate of Information Management; and the Directorate of Plans, Training, and Mobilization. This office is the primary liaison between post protocol and the Engineer School for all visitors, foreign and domestic.

History Office. The Engineer Branch historian serves as the proponent for historical activities of the Engineer Branch and acts as the point of reference for the history of the branch. He advises the commandant on Army and TRADOC historical-program responsibilities and represents the commandant on matters relating to military history. The historian prepares periodic documented histories of the Engineer Branch dealing with significant mission-related activities. He develops and administers the historical source-document collection, including significant, unique, and rare printed and nonprinted material, as the corporate memory of the branch. He serves as a consultant and adviser for inclusion of military history into the curricula.

Engineer Museum. The director of the Engineer Museum strives to foster an appreciation for the history and tradition of the Corps of Engineers, Fort Leonard Wood, and the U.S. Army. He collects, preserves, documents, exhibits, and interprets objects of historical interest pertaining to the history of U.S. Army Engineers, from 1775 to the present. He develops and conducts historical education and training programs for initial-entry-training soldiers, students, and permanent-party military personnel. He works with the museum counsel to collect, preserve, document, exhibit, and interpret objects of historical interest pertaining to the history of Fort Leonard Wood, from 1940 to the present.

Directorate of Training

The Director of Training manages and provides overall administrative services for engineer training, training and doctrine development, countermine training, humanitarian-demining training, and the engineer portion of the Armywide Doctrinal and Training Literature Program.

Following the director's lead, the DOT staff and the engineer personnel within the MANSCEN's Directorate of Training Development (DOTD) plan the engineer training strategy, develop leader and soldier training, and pursue Army Training XXI initiatives. The director serves as the course director for engineer officer courses and also serves as liaison with the DOTs of the MP and Chemical Schools. The director provides oversight to two relatively new entities—the Countermine Training Support Center and Humanitarian Demining Training Center. He leads the development and revision of engineer doctrine. He ensures the right quantity and quality of engineer soldiers through the Engineer Personnel Proponency Office and directs evaluation of training through The Army School System Division. Finally, he monitors the progress of workload accomplishment as outlined at the beginning of each fiscal year regarding the following actions. He directs corrective action relative to these actions or recommends required adjustments to the AC.

- Engineer training development.
- Engineer doctrine development.
- Engineer personnel proponency.
- Engineer training evaluations.
- Engineer officer training.
- Countermine and humanitarian-demining initiatives.
- Environmental training and doctrine development.

1st Engineer Brigade

The 1st Engineer Brigade consists of one U.S. Army Forces Command (FORSCOM) combat engineer battalion—the 5th Engineer Battalion (C) (M)—three TRADOC training battalions—the 35th Engineer Battalion (one-station unit training [OSUT]), the 169th Engineer Battalion (advanced individual training [AIT]), the 554th Engineer Battalion (the Engineer Officer Basic Course [EOBC], the Engineer Captain's Career Course [ECCC], and the warrant officer courses)—and one training support battalion—the 577th Engineer Battalion.

The brigade's formal mission is as follows: The 1st Engineer Brigade trains values-based and combat-ready soldiers, sailors, airmen, marines, leaders, and units for war. On order, it supports Reserve Component units, writes doctrine, and develops training concepts to support operations on all future battlefields. It is prepared to support contingencies, mobilizations, disaster plans, and to provide subject-matter experts worldwide.

The brigade trains AIT and OSUT soldiers in a variety of military occupational specialties—combat engineers, heavy-construction engineer-equipment operators, crane operators, engineer tracked-vehicle crewmen, carpentry and masonry specialists, divers, technical-engineering specialists, and engineer-equipment repairers. Depending on the specialty, soldiers can learn skills such as electrical wiring, surveying, computer-aided design, landmine warfare, combat-vehicle operation, and demolitions. Similarities in specific fundamental training within the Army, Air Force, Marines, and Navy allow students from all the services to train within the brigade.

The brigade is also responsible for teaching EOBC, ECCC, the warrant officer courses, and the highly demanding Sapper Leader Course. The EOBC focuses on preparing lieutenants to be platoon leaders, and the ECCC focuses on preparing captains for company command. The 28-day Sapper Leader Course focuses on small-unit leadership for combat engineers companies.

TRADOC System Manager (TSM)–Engineer Combat Systems

The TRADOC commander assigns systems managers to high-priority research-and-development projects and stations them at the proponent schools. Our TSM has responsibility for the Grizzly, Wolverine, Hornet, Raptor, Mongoose, and Standoff Minefield Detection System. He represents the Engineer School and the engineer soldier at all levels for system development, testing, and fielding, as assigned. He is the principal TRADOC/Engineer School interface with materiel developers, ensuring integration of doctrine, training, organizational concepts, and materiel requirements (logistics, training, leader development, soldier issues, and MANPRINT) on systems as assigned. He also sustains a close working relationship between TRADOC, the Engineer School, and partners in industry.

TRADOC Program Integration Office–Terrain Data (TPIO-TD)

TPIO-TD is the Army's centralized manager for coordinating and synchronizing all Army digital terrain-data requirements and for digital force development and training, experimentation, combat developments, training, and modeling and simulation. It also integrates terrain-data and geospatial engineering requirements for live, virtual, and constructive modeling and simulation for the training, exercises, and military operations; advanced concepts and requirements; and research, development, and acquisition domains.

The Terrain Visualization Center (TVC) director is subordinate to TPIO-TD and serves as the TRADOC proponent for geospatial information and services (GI&S). He supports the TPIO-TD on GI&S issues as the TRADOC representative on the Army Topographic Engineering Coordinating Committee. He and his staff provide services to a variety of entities at MANSCEN-and-above levels.

Directorate of Environmental Integration (DEI)

Through its DEI, the Engineer School serves as the Army proponent for the development, integration, and evaluation of environmental considerations into and across the domains of doctrine, training (military and civilian), leader development (military and civilian), organizational design, materiel development requirements, and soldier/civilian support. The DOEI was recently created to address this mission. It consists of three divisions: (1)Evaluation, Standardization and Synchronization Division; (2)Doctrine, Organizational Design and Materiel Development Division; and (3)Training, Leader Development and Soldier/Civilian Support Division.

School-Related MANSCEN Organizations

A variety of school-related MANSCEN organizations perform activities that serve all three schools:

- **DOTD** is responsible for the horizontal integration of training-development activities.
- **DCD** provides horizontal integration of combat-development activities.
- The **Maneuver Support Battle Lab** plans and conducts warfighting experiments related to maneuver support.
- The **Directorate of Common Leader Training** conducts all officer core training across the three schools. (Each school provides branch-unique officer training.) Course start dates are aligned so that this department can teach all common portions.
- The **NCO Academy** teaches NCO professional-development courses for all three MANSCEN branches. The commandant is a command sergeant major.

Summary

The Engineer School is a team of teams that provides the engineer doctrine, training, force structure, leader development, materiel requirements, and soldiers to meet the needs of the Army and warfighting CINCs today and in the future. It is a key member of the U.S. Army Maneuver Support Center team that addresses the maneuver support requirements of the Army as it lays the groundwork for transformation to the Objective Force.

Mr. Evans is the training-development-integration officer in the Directorate of Training at the U.S. Army Engineer School. He holds a master's in counseling from Central Missouri State University in Warrensburg, Missouri, and has completed postgraduate work in training technology.

Letter To The Editor

Facing the CSS Challenge

In the article "Facing the CSS Challenge" (May 2001 issue of *Engineer*), the authors concluded that the engineer support element (ESE) is insufficiently resourced and structured to adequately support the engineer battalion. I agree. To add to the argument, combined with the aging of the engineer fleet and the addition of the Wolverine to engineer battalions' modified table of organization and equipment, the ESEs cannot conduct recovery missions and maintain the fleet simultaneously. As experienced during recent field exercises and the division capstone exercise (DCX), recovery has become a full-time mission for the ESE. Also, those soldiers who man the recovery vehicles are too occupied to maintain the vehicles that they are supposed to support. When the vehicles cannot be fixed on-site, they need to be recovered. This results in a backlog of equipment at the unit maintenance-collection points that does not get repaired since the maintainers are still recovering other vehicles. Clearly, there was risk accepted in the ESE design by giving these soldiers dual responsibility, but risk has negatively affected the engineer battalion's ability to perform its mission. To support the engineer battalion, the ESE needs to be redesigned so that recovery and maintenance can occur simultaneously.

MAJ J. Gary Hallinan
U.S. Army TACOM
Warren, Michigan

Engineer School's Reply

Thank you for your comments. During the DCX, the engineer and the Combined Arms Support Command (CASCOM) units, as well as observers, agreed that there were significant problems with the ESE's ability to provide adequate battalions. It received official recognition as an issue to be resolved during the 4th Infantry Division's documentation action review team (DART) conference at Fort Hood, Texas, 21 to 24 May 2001. As a result of this status, TRADOC has directed the Engineer School and CASCOM to answer the following questions:

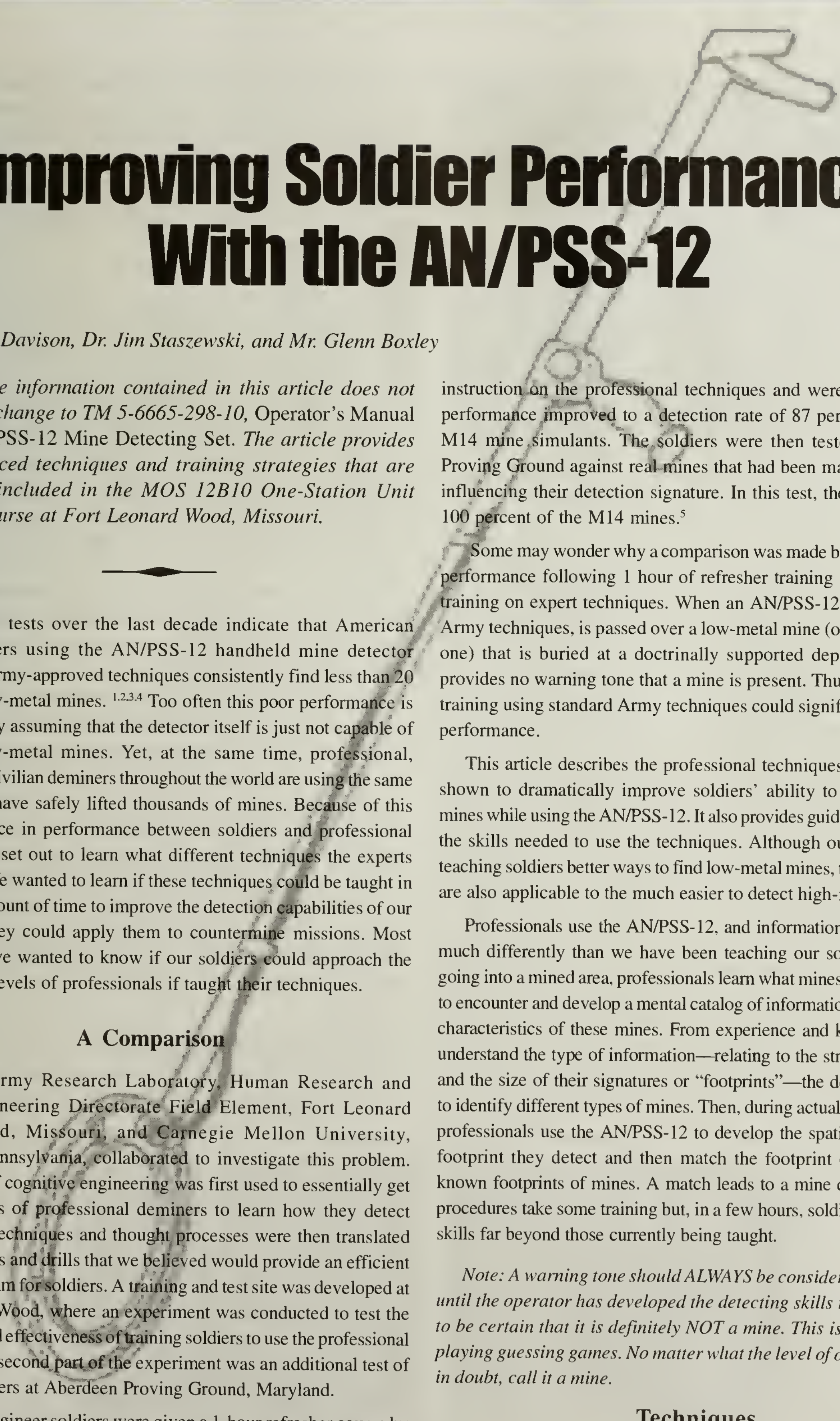
- *What is the minimum number of personnel required to support the engineer battalion—in terms of manpower requirements criteria?*
- *What is the correct structure for these personnel—platoon, section, or company?*
- *Who should the parent unit be—forward support battalion or engineer battalion?*

When these questions are answered, then the process to change the current design can proceed and a methodology to pay for any increases in personnel can be determined. The Engineer School and CASCOM have started the process of working together to answer TRADOC's questions.

Mr. Garry N. Hamlet
Force Documentation Analyst

Improving Soldier Performance With the AN/PSS-12

By Dr. Alan Davison, Dr. Jim Staszewski, and Mr. Glenn Boxley



Note: The information contained in this article does not represent a change to TM 5-6665-298-10, Operator's Manual for the AN/PSS-12 Mine Detecting Set. *The article provides some advanced techniques and training strategies that are now being included in the MOS 12B10 One-Station Unit Training Course at Fort Leonard Wood, Missouri.*

Formal tests over the last decade indicate that American soldiers using the AN/PSS-12 handheld mine detector and Army-approved techniques consistently find less than 20 percent of low-metal mines. [1,2,3,4] Too often this poor performance is rationalized by assuming that the detector itself is just not capable of detecting low-metal mines. Yet, at the same time, professional, commercial, civilian deminers throughout the world are using the same detector and have safely lifted thousands of mines. Because of this great difference in performance between soldiers and professional deminers, we set out to learn what different techniques the experts were using. We wanted to learn if these techniques could be taught in a practical amount of time to improve the detection capabilities of our soldiers so they could apply them to countermine missions. Most importantly, we wanted to know if our soldiers could approach the performance levels of professionals if taught their techniques.

A Comparison

The Army Research Laboratory, Human Research and Engineering Directorate Field Element, Fort Leonard Wood, Missouri, and Carnegie Mellon University, Pittsburgh, Pennsylvania, collaborated to investigate this problem. The science of cognitive engineering was first used to essentially get into the minds of professional deminers to learn how they detect mines. Their techniques and thought processes were then translated into procedures and drills that we believed would provide an efficient training program for soldiers. A training and test site was developed at Fort Leonard Wood, where an experiment was conducted to test the practicality and effectiveness of training soldiers to use the professional techniques. A second part of the experiment was an additional test of the same soldiers at Aberdeen Proving Ground, Maryland.

Initially, engineer soldiers were given a 1-hour refresher course by NCOs on standard Army techniques and were then tested using those techniques. They found less than 15 percent of the low-metal antipersonnel M14 mine simulants. They were then given 15 hours of instruction on the professional techniques and were retested. Their performance improved to a detection rate of 87 percent against the M14 mine simulants. The soldiers were then tested at Aberdeen Proving Ground against real mines that had been made safe without influencing their detection signature. In this test, the soldiers found 100 percent of the M14 mines.[5]

Some may wonder why a comparison was made between soldiers' performance following 1 hour of refresher training and 15 hours of training on expert techniques. When an AN/PSS-12, using standard Army techniques, is passed over a low-metal mine (or even held over one) that is buried at a doctrinally supported depth, the detector provides no warning tone that a mine is present. Thus, no amount of training using standard Army techniques could significantly improve performance.

This article describes the professional techniques that have been shown to dramatically improve soldiers' ability to find low-metal mines while using the AN/PSS-12. It also provides guidance on teaching the skills needed to use the techniques. Although our focus was on teaching soldiers better ways to find low-metal mines, these techniques are also applicable to the much easier to detect high-metal mines.

Professionals use the AN/PSS-12, and information gained from it, much differently than we have been teaching our soldiers.[6,7] Before going into a mined area, professionals learn what mines they can expect to encounter and develop a mental catalog of information describing the characteristics of these mines. From experience and knowledge, they understand the type of information—relating to the strength of signals and the size of their signatures or "footprints"—the detector provides to identify different types of mines. Then, during actual detection work, professionals use the AN/PSS-12 to develop the spatial image of the footprint they detect and then match the footprint obtained to the known footprints of mines. A match leads to a mine declaration. The procedures take some training but, in a few hours, soldiers can develop skills far beyond those currently being taught.

Note: A warning tone should ALWAYS be considered to be a mine until the operator has developed the detecting skills that enable him to be certain that it is definitely NOT a mine. This is no place to be playing guessing games. No matter what the level of operator skill, if in doubt, call it a mine.

Techniques

Soldiers must understand the basic capabilities and limitations of the AN/PSS-12 to be able to properly employ it. The detector emits a magnetic field symmetrically above and below the detector head. When this field encounters metal objects, it induces currents in these objects. The larger the metal objects, the stronger the induced currents, and thus the greater distance at which the receiver component of the detector can pick up the induced currents. In practical terms, this means that the detector is able to detect high-metal mines from a distance of several feet, but low-metal mines can be detected from only a few inches (see Figure 1). If the detector head is not swept very close to a low-metal mine, the mine will not be detected.

Physical Setup

The AN/PSS-12 in the Army inventory is referred to by the manufacturer as an AN/PSS-12 Mod 2. Some design limitations of this model require that precautions be taken in the physical setup of the detector to get the best performance. The detector shaft is a telescoping pole composed of two pieces; the bottom piece is plastic and the top piece is aluminum. The cable that connects the head to the electronics unit is attached to the shaft with plastic clips. The first clip should be placed at the base of the shaft with a small loop in the cable between the detector head and the first clip. This allows some flexibility in movement of the head without damaging the connection of the cable to the head. Additional clips should then be placed along the plastic portion of the shaft to hold the cable away from the shaft. The top clip should be placed at the uppermost portion of the plastic section of the shaft. The cable should not be attached to the aluminum portion of the shaft because it may cause sensitivity to fluctuate.

The electronics unit is designed to either attach to a web belt or be slung over the shoulder using the shoulder strap. We recommend that the electronics unit be attached to the web belt so it will swing less. We also recommend that the cable length between the shaft and the electronics unit be held in the hand that is not operating the detector. If the cable is swinging around, it can hurt the detector's performance.

Initial Sensitivity Setting

Properly setting and maintaining the sensitivity of the detector is absolutely crucial to performance. Most soldiers adjust the sensitivity using the test piece provided in the kit. They hold the test piece so the metal component inside is 2 inches from the detector head, and then they adjust the sensitivity so they get a signal from the detector. This is a setup for failure! Once they put the detector in use, they sweep the head 2 or more inches above the ground. Thus buried low-metal mines are out of range of the electric field the detector was just set to detect, and there is virtually no chance of detecting a low-metal mine.

The test piece provided in the kit is an excellent device to hold near the detector head to determine if the detector is working properly. It should not be used to set the sensitivity by holding it in the air 2 inches from the detector head.

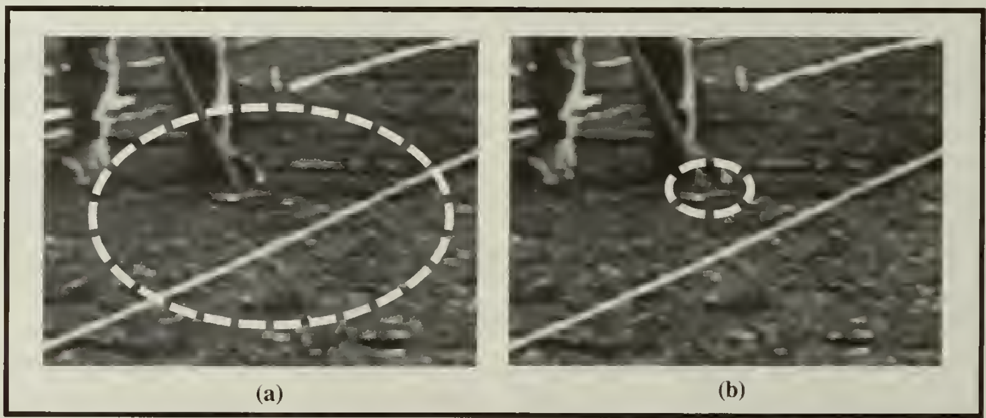
The sensitivity may be properly set in either of two ways. The best way is to have on hand the most difficult to detect type of mine that is expected to be encountered. Bury this mine at the deepest depth the threat is expected to have buried it. Place the detector head lightly on the ground directly above the mine, and then adjust the sensitivity so the mine can be detected with a clear warning tone.

As an alternative, if the threat mine described above is not available, bury the test piece vertically at the deepest depth the threat mine is expected to be encountered. (The depth of the metal component in the test piece is the critical issue.) Then place the detector head lightly on the ground just above the test piece, and set the sensitivity so that the test piece can be detected with a clear warning tone. Adjusting sensitivity with a mine or test piece buried in soil similar to where the detector will be used is very important. Otherwise, sensitivity setting is simply a guess. Different soil types and moisture content influence the sensitivity of the detector.

The process above describes the minimal sensitivity setting required. Anything less will result in missing a mine. If the soil allows, without producing a warning tone from the detector, the sensitivity may be set at higher levels. This theoretically yields a greater probability of detection at the cost of a higher false-alarm rate. The mission dictates the optimal setting of the sensitivity between just enough to detect the hardest to detect mine at the deepest depth to the highest setting the soil type will allow without generating a warning tone that could hide the tone indicating a mine. Due to time constraints, a tactical mission such as a combat breach may require a riskier, lower sensitivity setting. A higher sensitivity setting would be used during a non-time-constrained demining mission or clearing of a lodgement area or route.

Maintaining the Sensitivity Setting

A deficiency of the AN/PSS-12 Mod 2 is that its sensitivity drifts over time.[8] Professionals check the sensitivity frequently (nearly every


(a)

(b)

Figure 1. (a) The detector induces a large electrical field from a high-metal mine such as an M15 antitank mine or an M16 antipersonnel mine. (b) The detector induces a much smaller detectable field from a low-metal antipersonnel mine such as an M14.

0.5 meter of advance) and, if required, reset the sensitivity. During training, we taught soldiers to check their detectors' sensitivity every 1 to 2 meters of advance.

Setup for maintaining a consistent sensitivity level is made at the time of the initial setting. With the initial sensitivity properly set while using a buried mine or the buried test piece, the detector head is moved to a nearby place on the ground over a clear area. A metal object is then slid down the shaft of the detector until the operator hears the same warning tone that was emitted when the detector head was placed over the buried mine or test piece. At this point on the shaft, the soldier positions one of the plastic cable clips, which becomes the sensitivity marker clip. Now, after every 1 to 2 meters of advance in the mine lane, the soldier can simply move the same metal object down the shaft to the sensitivity marker clip and listen to see if the same warning tone is emitted. If the same tone is not emitted, the sensitivity knob can be adjusted up or down to replicate the desired signal. A useful metal object for maintaining the sensitivity is a common mason's trowel, which can serve other purposes when mine detection is ongoing (see Figure 2).

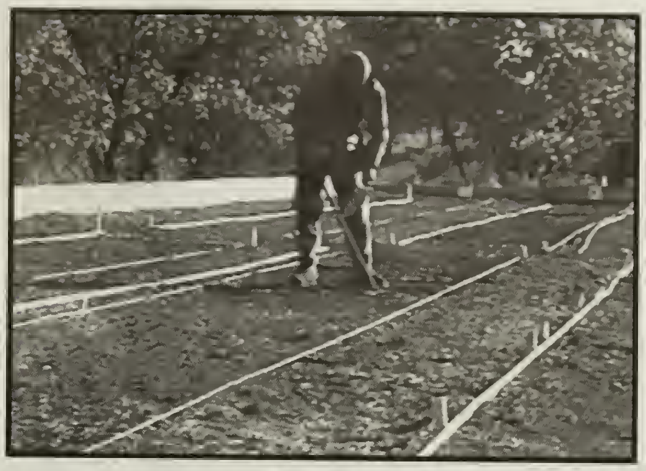


Figure 2. A soldier checks the sensitivity setting of the detector by feeling with a metal trowel for the edge of the electrical field. He is touching the tip of the trowel to the sensitivity marker clip.

Sweep Techniques

As explained earlier, the electric field emitted by low-metal mines is very small—often less than the width of the detector head. Therefore, each sweep across the lane must overlap the previous sweep by about one-half the width of the detector head. Otherwise, a gap is left between sweep paths and a low-metal mine can be missed. Uneven sweep spacing was found to be a major problem, even among more experienced soldiers.

A training device developed by Dr. Herman Herman of Carnegie Mellon University recorded the movement of the detector head over the ground and played it back to soldiers so they could evaluate their own performance.[9] Any gaps in ground coverage were shown by the device, and soldiers could correct their sweeping flaws.

The movement rate of the detector head is also important. The operator's manual advocates a sweep rate of 1 meter per second.[10] However, if low-metal mines are the threat, this is too fast because the detector head can be swept directly over these mines without emitting a warning tone. The detector head should be swept no faster than about 1 foot per second.

Head height above the ground is the most important factor concerning sweep techniques. The operator's manual advocates sweeping with the head "not more than 2 inches above the ground."[11] The authors observed that soldiers sweep with the detector head a minimum of 2 inches above the ground and often—especially at the end of sweeps—swing the detector head much higher. These techniques ensure that low-metal mines are not detected. The detector head should be lightly floated on the ground surface. The closer the detector head is to the ground, the deeper the electrical field is projected and the greater chance there is to detect low-metal mines. Actual contact with the ground appears to improve the electrical coupling, thereby strengthening the electrical field.

Loosening the nut on the plastic bolt that attaches the detector head to the shaft makes it easier to maintain constant contact with the ground. This allows the head to pivot, and the head can then be lightly slid across the surface. The head essentially follows the variations in the surface. In low vegetation, a different technique is to keep the nut tight so the position between the head and shaft is fixed. Then, the detector head is lightly patted on the ground, each pat advancing no more than one-half the width of the detector head.

In some instances, vegetation may prevent the detector head from getting on the ground. And we do not advocate pushing through vegetation to get the detector head on the ground. Different environments will require slightly different techniques, but the point is that if the detector head is not on or very near the surface of the ground, the detector is not going to help locate low-metal mines.

Practice

Just employing the proper techniques is not enough to successfully detect mines. As in developing any kind of skill, practice is required. And to support learning, a critical part of this practice is to provide soldiers with quick feedback on their performance. Our training program helped soldiers develop the skills of the experts by employing a series of drills, each building upon the other. Additionally, we found the process of mine detection to be one of precision. Failure to properly apply the techniques described accounted for most of the few mines missed during this research effort.

Edge-Detection Exercise

In this exercise, soldiers developed the fundamental technique to acquire patterns of information that signify buried mines. As mentioned earlier, professionals use the detector as a tool to develop a spatial image of the detected object in the ground. The soldiers were taken to specific locations where a mine simulant was buried. A plastic poker chip marker was placed on the ground directly above the mine simulant. Facing the poker chip mark from a predetermined orientation (each soldier was told to arbitrarily consider that the poker chip marking the mine was to his north), each operator would place the detector's sensor head on the ground in a 3 o'clock (east) orientation to the mark. Moving the head on a line perpendicular to the north-south line connecting the operator's center with the poker-chip mark, the soldier was to determine the point at which the detector sounded off, while sweeping the head slowly in an east-west direction toward the mark. This position was marked with a small plastic golf-ball marker, and its distance to the target mark was measured and recorded by an observer (see Figure 3).

The type of mine was then revealed to the operator, as well as the distance measured from mine center to the "edge" mark determined by the operator. Each operator performed this exercise on five different encounters with each type of mine simulant (M14, PMA3, VS2.2, M15, and M16) for a total of 25 mine encounters.

Footprint-Development Exercise

This exercise introduced soldiers to the patterns or footprints that identify and locate buried mines. Soldiers repeated the previously described edge-detection technique from at least five different directions—for example, advancing the sensor head from different perimeter points (E, S, W, SE, SW) toward a target mark. For safety reasons, operators were told to move the head no closer toward the mine than was needed to establish an edge of the footprint. Each edge was to be marked, with all markers remaining in place until the task was completed. All center-to-edge distances were measured, recorded, and reported to the operators along with the identity of the buried target. Soldiers were instructed to describe the size and shape of each resulting pattern and compare and contrast the patterns obtained across trials. This helped develop a spatial image of the mine signature based on input from the detector. By familiarizing themselves with mine footprints, while also learning acquisition techniques, soldiers accumulated the knowledge needed to match footprints found later with those that identify mines and successfully find mines.

"Airborne" Technique Exercise

High-metal mines produce footprints that extend as far as 1 meter away from the mine's center. The purpose of the airborne technique is to locate the mine target within the extended footprint as accurately as possible and to avoid unplanned detonations caused by the sensor head contacting the prongs that trigger many high-metal antipersonnel mines (such as M16s or Valmara 69s). This technique involves fixing the sensor head so that it can be maintained in a position parallel to the ground surface while it is raised as high as 2 to 3 feet. By scanning the area within the footprint—and progressively increasing the height of the sensor head until small, upward or sideward, in-plane movements cause loss of signal from the AN/PSS-12—an operator can pinpoint the location of a buried mine by exploiting the tapered geometry of the detector's sensing field (see Figure 4).

Blind-Detection Exercise

After practicing the preceding techniques, soldiers engaged in a sequence of blind-detection tasks. Initially, these tasks began with each soldier being directed to a specific and bounded area to search. In each 1.5- by 1.5-meter cell, the task was to use the techniques taught to determine whether a mine was buried within the area's boundaries and, if so, to mark its location as accurately as possible. Soldiers received feedback on the accuracy of each detection before proceeding to the next cell. Each soldier then had the opportunity to resweep the area to familiarize himself with the target's footprint, especially if he missed the mine. After completing single-cell detection exercises, operators practiced blind search (with feedback) over progressively longer distances and time periods. The practice task progressed to cover 5-cell distances, then 10-cell distances, and finally an 18-meter test familiarization trial. Feedback on mine locations was provided on the conclusion of each soldier's training-lane sweep.

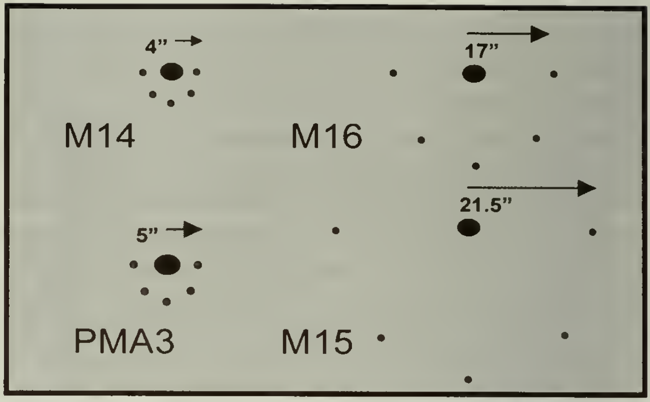


Figure 3. In the edge-detection exercise, the detector sounded off when the detector head was at the distances indicated for the various types of mines. Developing these points from multiple directions develops the patterns of footprints.

Training Requirements

We developed a training site that we hoped would optimize the training efficiency and, at the same time, be a facility that units in the field could practically replicate. Description of the training site is beyond the scope of this article, but we believe it played an important role in the training process.

Construction of high-fidelity simulants of low-metal mines was also a critical factor to support this research effort. Metal components

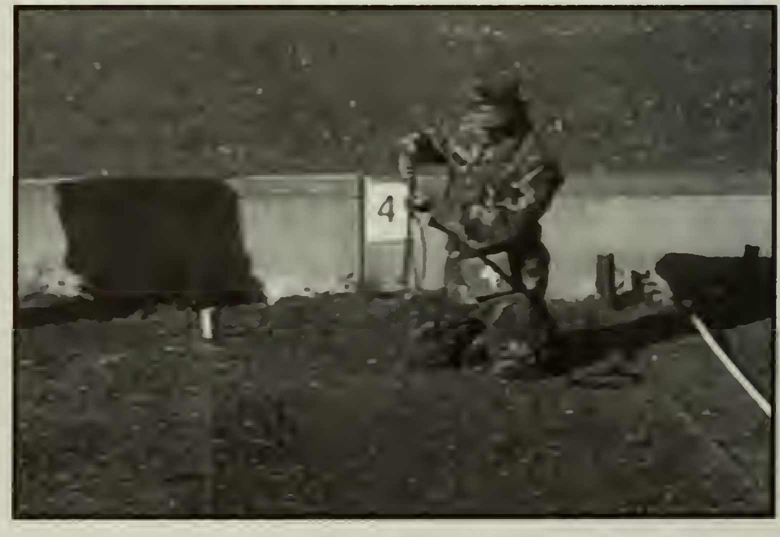


Figure 4. A soldier uses the airborne technique to accurately locate the center of mass of a large metal mine by using the tapered geometry of the electrical field.

were developed by the Program Manager's Office for Mines, Countermines, and Demolitions, Fort Belvoir, Virginia.[12] These very small metal components were inserted into hockey pucks to provide low-metal mine simulants. The simulants proved their merit when soldiers were trained on them at Fort Leonard Wood and later performed even better against the real mines at Aberdeen Proving Ground.

Use of bolts, nails, and other relatively large metal components as simulants are typically far too easy to detect and may perpetuate the continued use of improper detection techniques. The metal components used in the hockey pucks as carriers are an inexpensive and available source for high-fidelity, low-metal mine simulants.

Conclusion

The proliferation of low-metal mines over the past years has changed the techniques we must now use to successfully find mines. The old techniques were adequate for locating mines with high-metal content but are completely inadequate for low-metal mines. Many of the techniques advocated in this article, and validated by scientific research, were also described in an article in *Engineer* more than 6 years ago.[13] This research showed that gains in detection performance achieved by soldiers who received only 15 hours of training on the professional techniques resulted in more than a six-fold increase in performance on the hardest to detect mines. Most impressively, after being trained against mine simulants, the soldiers found 100 percent (63 of 63) of the hardest to detect M14 mines. The performance increase was so enormous (and statistically supported) that little doubt can be left about the validity of these techniques.

The professional techniques described in this article are only a part of mine-detection work, but we believe they can provide a critical supplement to other important factors of standard training, such as visual cue indicators and mine awareness. Training techniques must catch up with an evolving threat of low-metal mines. Employing standard Army techniques sets soldiers up for failure in a task that is swiftly and savagely unforgiving of human error.

The future promises improved mine detectors. The new Handheld Standoff Mine-Detection System (HSTAMIDS), which is progressing well, will offer two sensors. One will be an improved metal detector, and the other is a ground-penetrating radar sensor. Together, these sensors will provide soldiers information that may allow them to discriminate between mines and clutter. Assuming that soldiers will be properly trained, fielding this detector has the potential to provide a much greater capability to detect low-metal mines. For more information on the HSTAMIDS program, go to *http://www.wood.army.mil/TSM* or call (573) 563-4085.

This material is based on work supported in part by the U.S. Army Research Laboratory and the U.S. Army Research Office under grant number DAAG55-98-1-0147.

For more information on improving training with the AN/PSS-12 detector or setting up an effective training and test site, or to suggest ways to further improve the techniques described above, please contact one of the authors.

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Endnotes:

[1] U.S. Army Test Report, "AN/PSS-12 Metallic-Mine Detector," U. S. Army Test and Experimentation Command, Fort Hood, Texas, July 1991.

[2] W.C. Schneck, "Countermine in OOTW: Operation Restore Hope," a presentation to the U.S. Army Engineer School, Fort Leonard Wood, Missouri, 19-20 December 1994.

[3] U.S. Army Test Report, "Early Developmental Test/Early User Test and Evaluation of the Handheld Standoff Mine-Detector System," 1998.

[4] James J. Staszewski, Alan Davison, "Mine Detection Training Based on Expert Skill," *Detection and Remediation Technologies for Mines and Minelike Targets V*, A.C. Dubey, J.F. Harvey, J. T. Broach, and R. E. Dugan (Eds.), *SPIE Proceedings,* Volume 4038, pp. 90-101, 2000.

[5] Ibid.

[6] Ibid.

[7] James J. Staszewski, "Information Processing Analysis of Human Land Mine Detection Skill," Detection *and Remediation Technologies for Mines and Minelike Targets IV,* T. Broach, A.C. Dubey, R.E. Dugan, and J. Harvey, (Eds.), *SPIE Conference Proceedings*, Volume 3,710, pp. 766-777, Orlando, Florida, 1999.

[8] Y. Das, and J.D. Toews, "Issues in the Performance of Metal Detectors," Conference Proceedings of UXO FORUM '98, Anaheim, California, 5-7 May 1998.

[9] H. Herman and D. Inglesias, "Human-in-the-Loop Issues for Demining," T. Broach, A. C. Dubey, R. E. Dugan, and J. Harvey, (Eds.), *Detection and Remediation Technologies for Mines and Minelike Targets IV,* SPIE Conference Proceedings, Volume 3,710, pp. 797-805, Orlando, Florida, 1999.

[10] TM 5-6665-298-10, *Operator's Manual for the AN/PSS-12 Mine Detecting Set*, Headquarters, Department of the Army, 21 February 1992.

[11] Ibid.

[12] Project Manager - Mines, Countermines and Demolitions (Countermine Division), Scientific & Technical Report, Simulant Mines. http://www.uxocoe.brtrc.com/Technical %20Reports/sim-richard %20ess/SIM percent20Mines %20Report.htm, 21 October 1998.

[13] Captain Lawrence M. Chirio, "Lessons Learned: Kuwaiti Demining Operation,"*Engineer*, August 1994, pp. 25-28.

An Engineer Perspective of the JCF–AWE

By Lieutenant Colonel Scott F. "Rock" Donahue and Major Timothy E. Griffith

The Joint Contingency Force-Advanced Warfighting Experiment (JCF-AWE) is the Army's latest experimentation process for the light forces, and the culmination of the experiment occurred at Fort Polk, Louisiana, from 1-20 September 2000. During this time, the 1st Brigade Task Force, 10th Mountain Division (Light), Fort Drum, New York, was taking part in Rotation 00-10 at the Joint Readiness Training Center (JRTC) at Fort Polk. The Army's 4th Infantry Division, Fort Hood, Texas, spearheaded the digitization process and created the environment for the subsequent transformation to the Interim Brigade Combat Team (IBCT). The tactics, techniques, and procedures (TTP), lessons learned, and equipment from the light experiment were forwarded to the IBCT, which is currently being fielded at Fort Lewis, Washington.

This article presents the engineer perspective of the JCF-AWE and focuses on the digitization of light engineer forces, specifically the concepts tested, the results, and the lessons learned from the 41st Engineer Battalion's support to the 10th Mountain Division during the experiment. The purpose of the article is threefold:

- To highlight the JCF-AWE training objectives and the employment of engineer-modernization initiatives.
- To provide a summary trend analysis for each of the engineer initiatives.
- To discuss the road ahead for "harvesting these insights" and continued experimentation and modernization of light engineer forces.

Background

The 10th Mountain Division deployed a division assault command post to the JCF-AWE to provide digital command and control (C2). The command post included the assistant division engineer cell and a section of topographic engineers from the 30th Engineer Battalion (Topographic), Fort Bragg, North Carolina.

The engineer elements in the 1st Brigade Task Force were a task-organized sapper company (A/41st Engineer Battalion) composed of two light sapper platoons and a mechanized engineer platoon, 2/C/299th Engineer Battalion, Fort Hood; an assault-and-obstacle-platoon section consisting of eight small emplacement excavators (SEEs) and six deployable universal combat earthmovers (DEUCEs) from headquarters and headquarters company; a task-force engineer planning cell in the 3-17th Cavalry Squadron, 10th Mountain Division; a task-force engineer planning cell in the command-post exercise battalion Task Force 1-32 Infantry, 10th Mountain Division; a T3 dozer section from the 326th Engineer Battalion, 101st Airborne Division (Air Assault), Fort Campbell, Kentucky; and a section of topographic engineers from the 30th Engineer Battalion.

The 41st Engineer Battalion approached the experiment as a training event driven by the mission-essential task list that incorporated emerging technologies and TTP. The JCF-AWE was a tough, complex, and challenging exercise that enriched and engaged our philosophy to build on new and emerging technologies and war-fighting capabilities. The battalion's objectives were to—

- Become a more lethal, versatile, survivable, and sustainable light engineer force, capable of providing premier combat-engineer support to the combined-arms team.
- Conduct tough, realistic, and innovative training to standard, supplemented with experimental TTP.
- Develop bold and adaptive leaders for the joint experimental process.

Before the JCF-AWE, the 10th Mountain Division conducted new-equipment training, field-training exercises, command-post exercises, computer-training sessions, and contractor meetings/refinements. Since many of the challenges and processes leading up to the deployment could not be predicted, leaders were required to be flexible and willing to take calculated risks in the experimentation process.

JCF-AWE Objectives

The overarching objectives of the JCF-AWE were to—

- Improve the effectiveness and efficiency of joint command, control, communications, computers, and intelligence (C4I) through digitization, enhanced communications, and joint interoperability of systems, processes, and procedures.
- Enhance the capability and conduct of JCF operations within urban and complex terrain.
- Enhance the capability, conduct, and planning of early-entry operations for the JCF.

The experiment attempted to use knowledge-based digital systems to increase the lethality, survivability, and tempo of operations to assist our Army in winning the nation's wars. The Army is continuously analyzing and rethinking how and why it operates and whether it is using current and future technologies to their greatest potential. The analog processes used 10 years ago (and still today) must be questioned as to their applicability and efficiency in the digital environment.

The JCF-AWE also developed tactical and experimental objectives that were nested within the overarching objectives.

Tactical Objectives

The tactical objectives, which supported four primary missions (entry operations, search and attack, deliberate defense, and military operations in urban terrain [MOUT]), were to—

- Execute tactical deployment and redeployment activities.
- Execute movement to contact/search and attack.
- Execute an attack on a built-up area.
- Perform combat-service support and sustainment.
- Provide force protection.

Experimental Objectives

The experimental objectives, which supported the initiatives in the division assault command post as well as the brigade C2 nodes, were to—

- Test core systems and initiatives under field conditions that replicate the JRTC rotation.
- Assess the impact of lessons learned on tactical-operations-center operations and architecture.
- Test and refine the data collectors' plan.
- Test and refine the contractors' support plan.
- Gain initial feedback on the performance of core systems and initiatives.
- Provide after-action reviews that enhance future JCF-AWE collective training.

Engineer Initiatives

The 41st Engineer Battalion tested 11 engineer initiatives and a general C2 initiative—the Maneuver Control System (MCS)-Light computer system in the command posts and its connectivity with the Force XXI Battle Command Brigade and Below (FBCB2) platforms in the vehicles. The experimentation and evaluation strategy for each of the engineer initiatives was coordinated with subject-matter experts and contractors from numerous agencies. Each organization had strict guidelines and Battle Lab directives to ensure that the systems were tested and evaluated against three criteria: effectiveness, survivability, and suitability.

The initiatives were evaluated throughout the experiment according to their frequency of use. Initiatives like the M-Gator, skid steer, and high-mobility engineer excavator (HMEE) were evaluated daily, while some initiatives like the urban robot (URBOT), T3 dozer, and lightweight mobile obstacle breacher (LMOB) were evaluated only during the MOUT phase, which occurred during the last 2 days of the experiment. A summary trend analysis of each of the initiatives follows:

The **M-Gator** (Figure 1) provided the entire brigade combat team with a significant mobility asset that was used extensively in casualty evacuation during an attack in the MOUT phase of the rotation. It was a great combat multiplier that significantly enhanced our ability to move short distances over rough or swampy terrain. The following minor design improvements were recommended:

- Increase the vehicle's top speed (currently 17 miles per hour).
- Field with a tilt trailer for transport and support.
- Replace Fiberglass®/plastic with reinforced aluminum.
- Develop an adapter kit for litters.

Note: The U.S. Army Infantry School is working the Operational Requirements Document (ORD) for this vehicle, which will be known as the Lightweight Utility Mobility Enhancement System (LUMES).

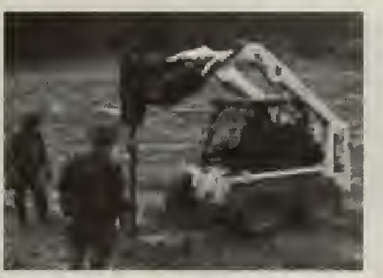
Characteristics

• Is a 6x4, two-seat, small tactical/utility vehicle.
• Has a 1.87-cubic-foot hood equipment tray and 14.4-cubic-foot rear cargo box.
• Hauls or tows a 1,400-pound payload.
• Has an 18-horsepower engine.

Figure 1. M-Gator

The **skid steer** was also a success story. We augmented our formations with two competing models: the Melroe Bobcat® Model 763 (Figure 2), a rubber-tired vehicle with steel tracks that could be manually installed over the tires if necessary, and the Caterpillar® ASV Model MD-2810, which had full-time rubber tracks for propulsion. The system has seven attachments: a picket pounder, clamshell bucket, auger, backhoe, pavement breaker, closed bucket, and forklift. The skid steer allowed units to start priority-position construction before the SEEs and DEUCEs arrived. Recommendations to improve the skid steer's performance include the following:

- Remove the rear bucket.
- Field a track-over-tire system for best results.
- Field with a tilt trailer for easier transport and support.
- Increase ground clearance for the Bobcat model.



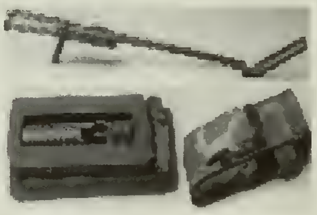
Characteristics

• Drives pickets and posts, pounds nails and spikes, excavates positions and shelters.
• Has easily changed attachments for many tasks.
• Lifts palletized materials and creates/ reduces obstacles.

Figure 2. Skid Steer

The **mini-mine detector (MIMID)** (Figure 3) was one of the best pieces of equipment tested during the JCF-AWE. The MIMID is based on the AN/PSS-12 handheld mine detector but is collapsible and more compact and has an improved package carrier. The MIMID is only an interim test system since the Maneuver Support Center's Directorate of Combat Developments has now decided to field the Handheld Standoff Mine-Detection System that detects nonmetallic and low-metal-content mines. The benefits identified for the MIMID are that it—

- Can be put into operation quickly.
- Is very effective in finding the center of mass of the object.
- Has a smaller search head, which saves time by decreasing the need to probe wide areas.
- Is easily transported and lightweight.
- Uses less of a battery's life than the AN/PSS-12.



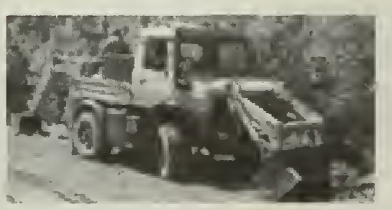
Characteristics

- Is one-piece, manpackable, and lightweight.
- Is collapsible.
- Can be carried on load-bearing equipment or in trouser pocket.

Figure 3. MIMID

The **HMEE** (Figure 4) is comparable to the SEE, but it digs faster because of its larger bucket and increased power. The HMEE was very reliable during the entire JCF-AWE. It always stayed mission-capable and was an integral part of the brigade's defensive effort. However, the HMEE's stature limited its mobility in restrictive terrain. Recommendations to improve the HMEE are to—

- Add rollover protection.
- Add HEMMT-type outriggers for stability.



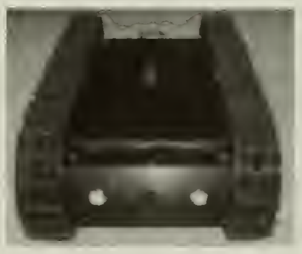
Characteristics

- Used for ditching, trenching, loading, and other related engineer missions.
- Is safe at up to 65 miles per hour on unimproved roads.
- Provides better cross-country mobility and digging capability than the SEE.

Figure 4. HMEE

The **URBOT** (Figure 5) is a good concept but needs refinement as an engineer initiative. It was very effective on its tether or within 100 meters. URBOT missions were limited to the MOUT reconnaissance phase and thus were relatively narrow in scope. It was also useful for finding trip wires. The following improvements will increase the URBOT's applicability for more missions:

- Increase its speed.
- Increase its durability.
- Mount a digitized photo capability and an infrared camera/zoom on the chassis.
- Increase the battery life so that it can operate longer between chargings.

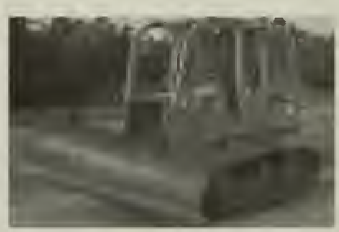


Characteristics

- Is manpackable (weighs less than 40 pounds).
- Operates for more than 2 hours on one charging.
- Has a line-of-sight range of more than 100 meters.

Figure 5. URBOT

The **T3 dozer** (Figure 6), like the URBOT, is a concept that the engineer community should continue to refine and improve. During the MOUT phase of the JCF-AWE, the T3 showed potential for unmanned breaching and clearing operations in built-up terrain. The system is too slow (its top speed is about 10 mph), and the camera should be upgraded since the digital images sent back to the operator were of poor quality. There were also problems when operating the T3 at distances more than 20 meters away. It is billed to be capable of remote operation at 1,000 feet, but we had difficulty anytime line-of-sight was lost.



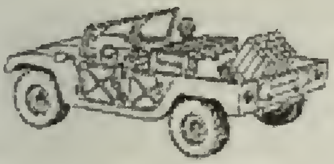
Characteristics

- Clears obstacles without risk to soldiers.
- Is video teleoperated.
- Removes rubble and other large obstacles.
- Is CH-47 transportable.

Figure 6. T3 Dozer

The **Volcano (Light)** (Figure 7) was another success story. It is extremely mobile and lethal, and the high-mobility, multipurpose wheeled vehicle (HMMWV) chassis reduces the system's signature while increasing its survivability. This scatterable-mine system uses the same canister as the regular Volcano but with only 20 canisters (half rack) instead of 40. Suggested modifications for the Volcano (Light) are to—

- Reinforce the HMMWV frame since it is hauling a heavy load of mines.
- Incorporate some type of rapid-reload capability into future versions.



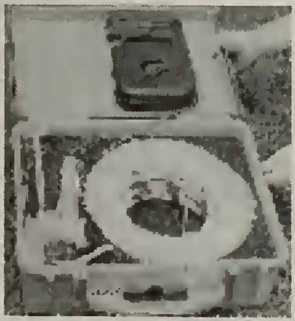
Characteristics

- Is a derivative of the Volcano that has been adapted to the HMMWV.
- Has a single half rack with a capacity for 20 canisters (120 antitank mines or 300 antipersonnel mines).
- Can lay 277 by 35 meters of disrupt or fix minefield.

Figure 7. Volcano-Light

The **LMOB** (Figure 8) is a work in progress. The concept is good, but the current technology needs refinement. The LMOB's design allows it to breach antipersonnel mines only, and it will not cut wire. These facts alone limit the applications for the LMOB in its current configuration. The breach lane width, advertised as 0.6 meters, is inadequate for a combat breach. Additionally, the breaching system weighs 55 pounds, and the mock trainer does nothing to simulate the breach. Therefore, it doesn't lend itself to dynamic training in the combined-arms breach.

The LMOB is currently fielded with a case, and we recommended a pouch or bag to facilitate dismounted transportation over long distances. The Maneuver Support Center decided not to continue investing in this initiative and will focus on the Antipersonnel Obstacle-Breaching System (APOBS) that will clear an adequate lane for light forces.

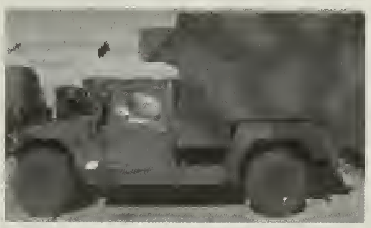


Characteristics

- Creates an 80-meter-long by 0.6-meter-wide footpath.
- Detonates surface-laid and buried antipersonnel mines, pressure-plate mines, and trip wires.
- Is manpackable (weighs 55 pounds).

Figure 8. LMOB

The **Digital Topographic Support System-Light (DTSS-L)** (Figure 9) is an example of the recent ability to move technology closer to the soldier. Current automation technology is mobile and deployed closer to tactical planners and decision makers. The DTSS-L can be deployed with brigade combat teams to provide dedicated and real-time topographic support. Some benefits of the system are that it allows the creation of improved map products for brigades and allows teams to stay on-site and engaged in current operations and planning. Additionally, the improved hardware and software in the DTSS-L is similar to the current garrison equipment and does not require new training.



Characteristics

- Provides a division terrain detachment with garrison-level capability while deployed.
- Has a HMMWV-mounted shelter.

Figure 9. DTSS-L

Rapid hardcopy reproduction (RHR) and **rapid terrain data generation (RTDG)** (Figure 10) significantly improve the terrain team's ability to provide support in the field. These capabilities allow large numbers of high-quality products to be printed very rapidly. The brigade requested 100 copies of high-resolution overhead imagery of the town for future MOUT, and the terrain team was able to meet that requirement and send the maps out on the next logistical package. The recommendation for the RHR trailer was to reconfigure the printer layout to maximize the limited space available.

Characteristics

- Provides hardcopy, nonstandard map-production capability directly from digital cartographic, terrain, and operational information.
- Produces at least 5,000 full-color, water-resistant standard products per day.
- Makes tactical decision aids and high-resolution image maps.
- Makes large-scale image maps.

Figure 10. RHR and RTDG

MCS-Light

The MCS-Light, a software program that allows engineers to effectively increase C2, is the baseline maneuver tool in the digital architecture for the 10th Mountain Division JCF-AWE. The system's unique features include the ability to post overlays and orders electronically, display real-time situational awareness of blue and near real-time of red unit icons, "chat" with other elements through the use of Microsoft® NetMeeting, and share common desktop folders and white boards. Information is shared with other MCS-Light users and— to a more limited extent—FBCB2 computers typically mounted in vehicles.

The old adage "a picture is worth a thousand words" holds true and should be the future course for reporting and sharing information. The inefficient analog method of sending pages and lists of raw data and grids requires the receiver to replot the grids on his map. The method of maintaining overlays and maps can now be manipulated electronically via MCS-Light. The engineer obstacle overlay can now be created on a digital map and passed to a common database or sent to another computer for display. Enemy obstacles and the status of main supply routes can be displayed on a digital map and sent to all units. Electronically sending digital maps and overlays eliminates the need to physically transfer acetate products.

It is imperative that the engineer community adopt a system that incorporates both planning and operational tools into a complete software package. Essentially, we recommend incorporating planning tools into the MCS-Light platform. The planning program should be menu-oriented and assist the user through the military decision-making process. The menu orientation would prompt and assist the user in remembering many of the considerations for the planning mission. Recommendations include the following:

- Improve the digital link between the MCS-Light and the FBCB2. (Minefields displayed on the MCS-Light need to constantly update and reliably post on the FBCB2.) This is critical information with lifesaving implications. Soldiers died on the JRTC battlefield because they didn't have situational awareness of mines.
- Improve the fidelity of the engineer graphics and symbols in the MCS-Light software.
- Add engineer spreadsheet planning tools (for example, the user enters units and receives equipment numbers and unit capabilities in terms of mobility/countermobility/survivability/sustainment engineering planning factors).
- Add engineer-specific tools for developing mission analysis, courses of action, commander's critical information requirements, etc., to facilitate the military decision-making process.

Supplemental training on the system at the Engineer Officer Basic Course is also required. We must develop an engineer system now that can meet our current and projected requirements; only then will we have a base from which to build or shift to be compatible with the maneuver architecture.

Future Experimentation and Evaluation

The JCF-AWE engineer initiatives have the potential to significantly improve the engineer's ability to support decisive, full-spectrum operations. Product refinements and subsequent experimentation must be continued to ensure that we get the best equipment in the hands of our light engineer forces. With an established, powerful, and proven experimental process like the JCF-AWE, we—as a multiservice/multicomponent engineer community—must continue our cooperative efforts to shape our future modernization strategy. This will require a systems-analysis process with other battlefield functional areas. The field artillery, air defense, and intelligence communities broke ground with their digital C2 initiatives—the Advanced Field Artillery Tactical Data System, the Air and Missile Defense Workstations, and the All-Source Analysis System—and are continuously working on building compatibility with the maneuver architecture as they evolve. Only through this type of cooperative modernization strategy can we sustain our relevance as a lethal, versatile, survivable, and sustainable combat multiplier on the modern battlefield.

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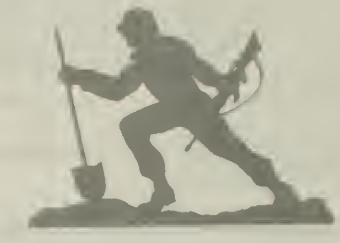
Major Griffith is the assistant division engineer, 41st Engineer Battalion, 10th Mountain Division, Fort Drum, New York. Previous assignments include engineer advisor for the U.S. Military Training Mission in Saudi Arabia; operations officer with the Corps of Engineers, assistant division engineer, 6th Infantry Division (Light), Fort Wainwright, Alaska; and commander of the 47th Engineer Company, 6th Engineer Battalion, Fort Wainwright, Alaska. He is a distinguished graduate of the Washington State University Reserve Officer Training Corps program and holds a master's in administration from the University of South Dakota.



BCTP Terrain Analysis: Unlocking the Mystery

By Chief Warrant Officer 2 Theodore W. Mohn

> *"Know the enemy, know yourself, your victory will never be endangered;*
> *Know the ground, know the weather, your victory will then be total."*
> *— Sun Tzu, 500 B.C., The Art of War*

As the Army's terrain experts, engineers understand the impacts and effects that terrain has on units conducting and supporting military operations. Within the engineer community, topographic engineers (military occupational specialty [MOS] 215D terrain analysis technicians and MOS 81T topographic analysts) are the subject-matter experts that maneuver commanders and their staffs rely on to provide timely and accurate terrain-analysis and terrain-visualization products. Topographic engineers routinely conduct terrain-analysis for contingency operations and support to engineer battlefield assessment (EBA) and intelligence preparation of the battlefield (IPB).

Terrain analysis is also conducted to support a unit's Battle Command Training Program (BCTP) evaluation. However, this analysis is unique because of the simulations aspect of the exercise. The BCTP's automation system uses Corps Battle Simulation (CBS) terrain data. This terrain has specific categories and specific terrain layers within those categories. To properly conduct an EBA and IPB during the military decision-making process, units must acquire CBS terrain. Topographic engineers have the ability and equipment to manipulate CBS digital terrain data and display the data for use in the unit's planning process.

This article explains CBS terrain data, how it works, and why planners and commanders involved in a Warfighter exercise need to understand the differences in CBS terrain data as it relates to existing terrain shown on hard-copy maps. When CBS is analyzed properly, it greatly increases the possibility for corps, division, and brigade commanders to decisively employ forces that are fully capable of defeating the World Class Opposing Force (WCOPFOR). Topographic engineers are vital in analyzing the CBS database, displaying CBS data in a usable format, and providing a thorough explanation of its effects on operations.

The BCTP

The BCTP, located at Fort Leavenworth, Kansas, is the Army's capstone combat-training center that demonstrates a unit's abilities to perform and execute combat operations and then identify their shortcomings. The BCTP provides command and battle-staff training to commanders of corps, divisions, brigades, and their staffs; major subordinate commanders; and supporting special operations forces. Worldwide battle-simulation centers (BSCs) provide the framework to conduct command-and-control training from joint-task-force to brigade-level operations. The BCTP provides a "free-thinking" WCOPFOR, certified observer-controllers/trainers, and senior observers as mentors and coaches. The combat-training center provides highly realistic and stressful joint, interservice, and combined-arms training according to Army doctrine.

CBS Terrain Data

CBS terrain is the "real terrain" during a BCTP exercise. Commanders and decision makers need to look beyond the thought that a map covering a BCTP exercise area is the most current depiction of the terrain. One should think of CBS terrain as information gathered, and then verified and published, by an engineer reconnaissance team, scout team, or intelligence collector. The result of their reconnaissance is CBS terrain, which is the only common operational picture of the battlefield. Units that take advantage of CBS terrain historically have greater success against the WCOPFOR.

Units participating in a BCTP Warfighter exercise need their supporting terrain teams to acquire CBS terrain data, which ensures that all participants are aware of the battle area. Terrain-analysis units can access this data from the National Simulation Center's CBS support teams. After downloading CBS terrain

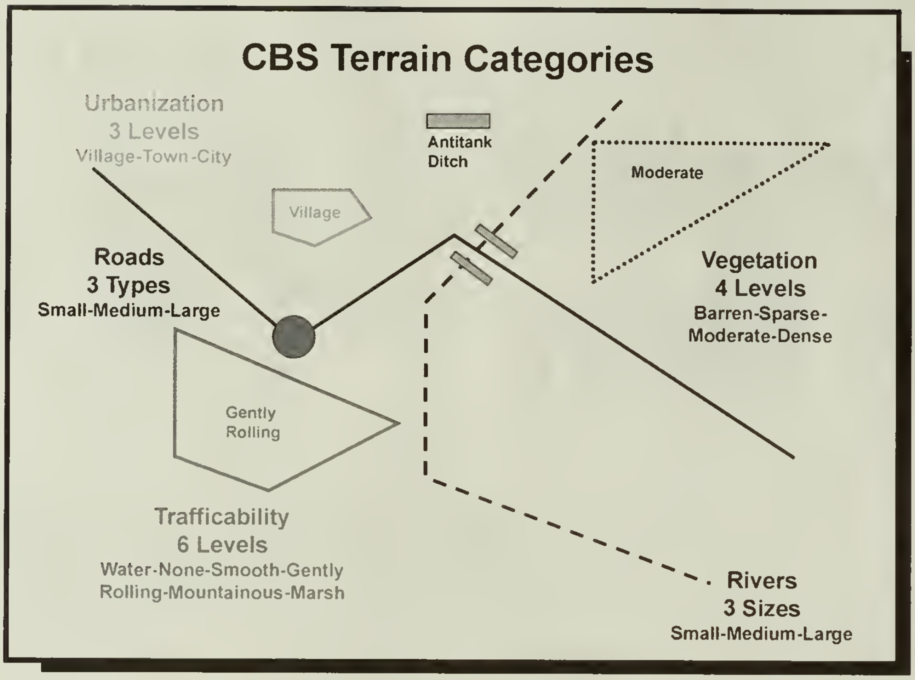


Figure 1

files, topographic engineers run each file through a series of conversions. Once converted, these files can be used in the automation systems that topographic-engineer units possess. Additionally, these files can be displayed using the latest version of Microdem/TerraBase II software. Engineers and other unit personnel (that are well versed in Microdem/TerraBase II) can perform their own limited analysis and visualization within the constraints of the software. This enables engineer commanders and staffs expanded access to the CBS terrain they must negotiate during a BCTP Warfighter exercise.

CBS terrain attempts to replicate a military map. However, computer capabilities and technologies limit CBS terrain categories and their layers to finite numbers. These categories consist only of roads, rivers, urbanization, vegetation, trafficability, bridges, and elevation/slope triangulated irregular networks (TINs). The first five terrain categories and their layers are shown in Figure 1. Bridges and TINs are discussed separately. Some common terrain features that do not appear in CBS are railroads, power lines, embankments, escarpments, levees, dams, pits, quarries, and tunnels.

Roads. Three types of roads are depicted in the CBS terrain data—large, medium, and small. Large roads are considered to be four lanes wide, and vehicles are permitted to achieve 100 percent of their maximum on-road speed. Maximum vehicle speeds are based on doctrinal vehicle characteristics. A medium road is considered to be two lanes wide, and vehicles are permitted to achieve 75 percent of their maximum on-road speed. Small roads are considered to be one lane wide, and vehicles are permitted to achieve 50 percent of their maximum on-road speed.

Rivers. Deliberate river-crossing operations require bridging assets. When units attempt river crossings at locations where no bridge exits, the following rules must be understood. A large river (greater than 47 meters wide) is nonfordable and requires a company's worth of bridging assets to cross. Medium rivers (20 to 47 meters wide) are nonfordable and require a platoon's worth of bridging assets to cross. Small rivers are fordable anywhere along the river course. However, without a bridge, units that cross/ford small rivers incur a 20-minute movement delay for bank-to-bank crossings.

Urbanization. This category of data is broken into villages, towns, and cities. The major effect that urbanization has on mobility is congestion. Units traveling on roads through these population centers incur a 20 percent degradation in vehicle speeds. Units must stay on roads to travel through urban areas.

Vegetation. Vegetation layers include barren, sparse, moderate, and dense forests. These categories also reduce off-road mobility rates. Figure 2 identifies speed-reduction rates based on the combination of slope and vegetation categories. Additionally, moderate and dense forests afford some level of concealment for all units (including the WCOPFOR). Moving through a dense forest without roads almost halts vehicle progress.

Trafficability. Layers in this category are water; none (no negative effect); smooth, relatively flat areas; gently rolling hills; mountains; and marshes. The three layers that severely reduce off-road movement rates are water, mountains, and marshes. Water is impassable, mountains add an additional 25 percent speed reduction to include restrictions already applied by the combination of vegetation and slope, and marshes reduce speeds to roughly 1 kilometer per hour.

Bridges

CBS terrain software automatically places a bridge wherever a road crosses a river, and regardless of the river or road type, these bridges have a default military load classification of 100. This allows freedom of movement for both the WCOPFOR and exercising units.

CBS Movement Rates

Figure 2 terrain layers, combined with the TIN file, are used to compute on- and off-road movement rates or speeds. Movement impediments are applied equally and without bias to the WCOPFOR and the unit being evaluated. CBS terrain is neutral to all participating forces involved in the exercise. The slowest a vehicle can travel in CBS is 1 kilometer per hour even in the most restrictive and difficult terrain. Open water is the only "no-go" terrain.

CBS Movement Rates

Roads	Rivers
Large - 100% of vehicle speed (4 lanes)	Large - >47 meters wide, bridge company required
Medium - 75% of vehicle speed (2 lanes)	Medium - 20-47 meters wide, bridge platoon require
Small - 50% of vehicle speed (1 lane)	Small - <20 meters wide, fordable with a 20-minute d ay

Slope	Barren	Sparse	Moderate
0-3%	.75	.70	.55
3-7%	.70	.65	.48
7-12%	.50	.45	.35
12-25%	.35	.30	.30
25-55%	.20	.18	.15

(Additional 25% degradation in mountainous areas)

Urban areas - Additional 20% degradation
Congested areas - Additional 30% on medium roads
- Additional 50% on small roads

Figure 2

There is no formula that can determine exact speeds for vehicles moving cross country. Calculating unit- and vehicle-movement rates over varying terrain is difficult using any existing Department of Defense-approved mobility model. The Army-accepted models are the National Imagery and Mapping Agency's (NIMA's) Cross-Country Mobility Model and the North Atlantic Treaty Organization Referenced Mobility Model. Both models require extensive terrain information and only calculate movement rates for one vehicle at a time, using different algorithms as determined by the programmers and contractors who built the models. Therefore, calculated speeds are slightly different between the programs for vehicles traversing the same terrain. Mobility programs only calculate approximate movement rates based on doctrinal vehicle characteristics and fidelity of terrain information used in the software package.

CBS uses its own set of terrain layers, algorithms, and doctrinal vehicle characteristics to calculate unit and vehicle movement rates. Figure 2 reflects an approximation of the rates calculated in CBS software. The numbers and percentages depicted come from CBS terrain editors at Fort Leavenworth. Unit movement rates (platoon, company, battalion, brigade) may only achieve the maximum doctrinal speed of the unit's slowest vehicle.

Only the CBS computer system can calculate the exact speed of a vehicle (unit) at a specific location (grid) at a specific time in the exercise. The system has an independent set of algorithms for combining terrain layers and calculating speeds. CBS also uses a different type of elevation data than that of the standard NIMA Digital Terrain Elevation Data (DTED).

BCTP Elevation Data

The National Simulations Center uses a TIN elevation model to replicate the earth's surface. TINs represent the earth's surface using contiguous, non-overlapping triangles (see Figure 3). This is different from the DTED (a grid-based elevation model) and the Digital Elevation Model (DEM) produced by the United States Geological Survey (USGS).

Unlike the DTED and DEM, the TIN only affects air-to-ground and ground-to-air line of sight. There is no effect on ground-to-ground line of site. Therefore, friendly and WCOPFOR maneuver units visually acquire each other as if the world were perfectly flat.

CBS Terrain Data Layers

The 25th Engineer Detachment (Terrain), Schofield Barracks, Hawaii, takes full advantage of CBS terrain during exercises run from the simulation centers. On day one of the mission analysis, the detachment displays CBS terrain data to the battle-staff members and explains how it works. Once the battle staff understands that only roads, rivers, urbanization, bridges, trafficability, vegetation, and TIN categories are used in CBS for exercise purposes, they accept these features as fact and continue with their doctrinal planning. By knowing where the CBS terrain features exist in the exercise, the battle staff can better formulate courses of action and predict possible enemy courses of action.

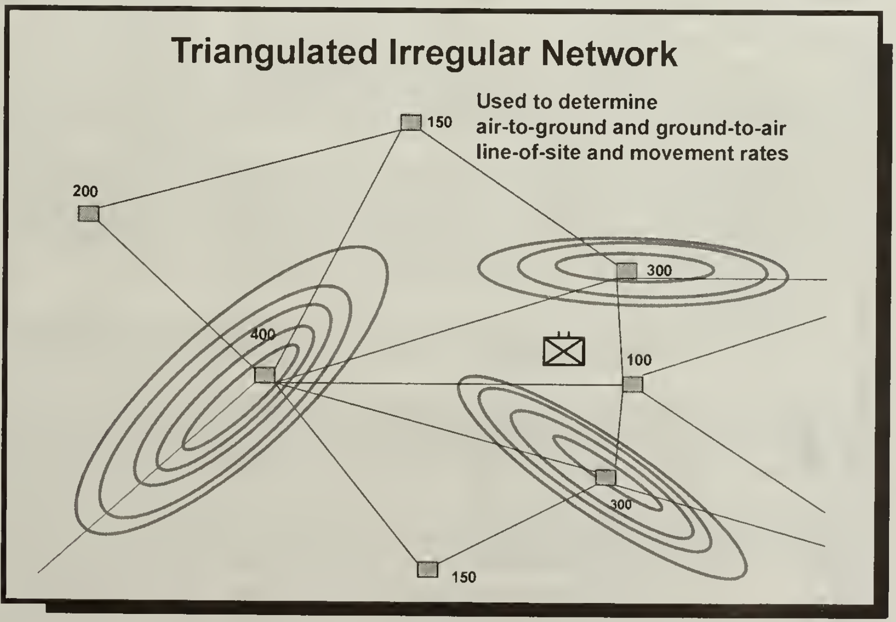

Triangulated Irregular Network
Used to determine
air-to-ground and ground-to-air
line-of-site and movement rates
150
200
300
400
100
300
150

Figure 3

(Continued on page 57)

Integrating an RC Engineer Battalion Into an AC Maneuver Exercise

By Major Todd M. Jacobus

The 224th Engineer Battalion (Mechanized), an Army National Guard unit in Fairfield, Iowa, has line units in the southeast Iowa communities of Burlington, Ottumwa, Mount Pleasant, and Keokuk. The 834th Engineer Company, a divisional engineer company headquartered in Davenport, Iowa, is attached to the 224th for command and control purposes.

The mission statement of the 224th is threefold. On H-hour, M-day, the battalion moves to the mobilization station to conduct post mobilization operations and, on order, deploys to the theater of operations to provide corps-level mobility, countermobility, and survivability support. When called on, the 224th provides organized, trained, and equipped soldiers to protect life and property, preserve peace and order, and provide public safety under the orders of the governor. Finally, the battalion participates in local and state projects and programs that add value to the organization and the Iowa Army National Guard. The table on page 31 shows the variety of missions that the 224th Engineer Battalion has performed during the past 10 years.

Training Plan

During training year 1996, the commander of the 224th presented the battalion's training plan for the next 5 years. The unit needed to continue taking advantage of training opportunities with the separate infantry brigades, its war trace higher headquarters, the training support brigade, overseas deployments, and rotations at the combat training centers. But, above all, the commander wanted to see the 224th hone its war-fighting skills by linking up with Active Component (AC) maneuver units. Because of personnel turnover, every other year or every third year would be a "back-to-the-basics" year where the unit would consolidate its mobilization station to validate squads and platoons in critical tasks from its mission-essential task list (METL). By conducting validations during these off years, the 224th would have well-trained engineers available for linking up with maneuver units. This philosophy was implemented in training years 1996-1997, and follow-on battalion commanders embraced this philosophy and continued to implement it in training years 1998-2000.

In January 1999, the 224th contacted the 1st Infantry Division, Fort Riley, Kansas, and requested a linkup with a maneuver brigade sometime during training year 2000. The division sent the request to the brigades and received a reply from the 1st Engineer Battalion and 1st Brigade Combat Team (BCT) at Fort Riley that they could use the 224th for a National Training Center train-up scheduled for July-August 2000.

The battalion commander's objectives for training year 2000 were to—

- Conduct safe movement to and from the annual-training location.
- Conduct linkup with a maneuver element.
- Improve command and control, intelligence, and combat-service support to integrate the maneuver scenario into the 224th's annual-training plan.
- Improve proficiency on mobility and survivability at the platoon level.
- Improve the operations-order process.

- Qualify on crew-served weapons.
- Conduct training on the heavy-demolitions range and mine-clearing line charge (MICLIC).

Training Preparation

In preparation for the train-up, the units scheduled a reconnaissance of the training area, a planning conference, in-progress reviews, rock drills, and an officer-development program.

Reconnaissance

In March 1999, the 224th's S3 and operations sergeant visited Fort Riley to conduct reconnaissance and identify potential training areas, dig sites, ranges, the maneuver-area training-equipment site (MATES), and other support activities.

Planning Conference

An initial planning conference in October 1999 enabled the units to confirm training objectives and coordinate future in-progress reviews. In addition, they could establish a synchronization matrix, the command/support relationships during each phase of breaching operations, the standard operating procedure (SOP) for breach marking, and the type of survivability positions desired by the brigade commander.

Battle Drills

The 224th's commander modified the unit's battle drills to facilitate a seamless appearance between the 224th and the 1st Engineer Battalion. After receiving a tactical SOP from the 1st Engineer Battalion and the1st BCT, the 224th's line units began training to the 1st Engineer Battalion's battle drills during inactive duty for training.

Officer-Development Program

In May 2000, the commander, S3, and assistant brigade engineer from the 1st Engineer Battalion participated in a 2-day officer-development program at Camp Dodge, Iowa, which was conducted concurrently with individual weapons qualification on a weekend of inactive duty for training. The program provided hands-on training to prepare for some of the requirements of the annual training. The training validated the commanders' and platoon leaders' ability to perform troop-leading procedures, issue oral operations orders, and perform critical mobility tasks such as conducting enemy-obstacle reconnaissance, reducing an obstacle mechanically, and marking and clearing lanes in a minefield.

A soldier from the 224th Engineer Battalion trains on an individual demolition task.

The 1st Engineer Battalion commander's priority for the brigade reconnaissance element was to eliminate the combat security outpost to prevent a maneuver-on-maneuver fight. Next, the engineers would identify the main obstacle belt and the point of breach. This was no small task. If the main belt was not accurately portrayed, then large amounts of engineer

	224th Engineer Battalion Missions
Year	**Mission**
1991	Mobilized for Operation Desert Storm (as a corps wheel unit) and deployed to Grafenwohr Training Area, Germany, to support the 8th Infantry Division (transitioned to Corps Mechanized unit). Rotated through the Combat Maneuver Training Center in Hohenfels, Germany, where each of the line companies supported a maneuver task force.
1992	Conducted lanes training and combined-arms river-crossing operations with the 2d Brigade, 34th Infantry Division, at Camp Ripley, Minnesota.
1993	Provided relief to flooding communities throughout southeast Iowa after being ordered to state active duty.
1994	Performed engineer lanes training at Fort McCoy, Wisconsin.
1995	Participated in rotations at the Joint Readiness Training Center, Fort Polk, Louisiana, (three line companies) and supported a Blue Force rotation at the National Training Center, Fort Irwin, California (one line company).
1996	Executed squad-level lanes at Fort McCoy, Wisconsin.
1997	Supported the 45th Separate Infantry Brigade during company team assault lanes and a river-crossing exercise at Fort Chaffee, Arkansas.
1998	Provided mobility, countermobility, and survivability support to the 1st Cavalry Division at Fort Hood, Texas.
1999	Executed squad-level engineer qualification tables at Fort McCoy, Wisconsin.

resources would be expended on protective obstacles. The 1st Engineer Battalion commander did not have an engineer squad with the brigade reconnaissance team. Instead, there was only one engineer squad leader attached to the team. Lessons learned at the NTC show that the brigade reconnaissance team is quickly decimated and engineer assets lost if a great deal of equipment and personnel are put with this team.

The 1st Engineer Battalion commander discussed terms such as "zone of penetration" and "point of breach" and emphasized the importance of engineers thoroughly understanding and rehearsing the battle drill before movement. He outlined the battle sequence from an engineer perspective. The brigade reconnaissance team would take out the first target array, and the point of breach would be located. Engineers would have an assault, a support, and a reduction force. They would determine where the opposing force (OPFOR) had its battle positions and establish a point of breach based on that intelligence. The engineer company commander should take the lead on reducing obstacles, which would require that the engineers control maneuver assets at the point of breach. It would be imperative to get the assault force through the breach in less than 10 minutes. The unit should plan on 50 percent redundancy at the point of breach.

After the formal class, officers from the 1st Engineer Battalion and the 224th broke into three squads. The S3 appointed squad leaders, a platoon leader, and a platoon sergeant, and they were given a mission to mechanically breach a complex obstacle that had been built in the training area of Camp Dodge. During the troop-leading procedures, the commander of the 1st Engineer Battalion and his team helped officers of the 224th focus on what they needed to do during the final months of preparation for the annual training at Fort Riley.

Final Coordination

Following the officer-development program, there was a change of command at the 1st Engineer Battalion and the 1st BCT. Soon after, the 224th established a telelink between Camp Dodge and Fort Riley to discuss the upcoming training event with the new commanders. A continuous flow of information throughout the year was necessary for a seamless synchronization at the time of execution.

On 29-30 July 2000, the commander, executive officer, S3, S4, and company commanders of the 224th attended a final coordination meeting with the 1st Engineer Battalion. The commander of the 224th went through the operations order in detail with the company commanders, and they each briefed their plan for a final time to the battalion commander.

The Reserve Component Services Division at Fort Riley gave the 224th personnel a tour of the billets, mess hall, orderly rooms, hospital, post exchange, clothing-sales store, MATES, and range control and ammunition-holding areas. The 224th linked up with the 1st Engineer Battalion and made adjustments to the training areas, dig sites, and bivouac sites and then conducted a rock drill that included the battalion and company commanders, executive officers, and S3s from both battalions and platoon leaders from the 1st Engineer Battalion.

Training Execution

On 5 August, the 224th departed from home armories in five communities and convoyed to Fort Riley. After arriving at its destination, the battalion staged all vehicles in the motor pool and began mounting the Multiple Integrated Laser Engagement System and performing pre-field-training-exercise inspections. The tactical operations center (TOC) moved to the field the next day and located independently from the 1st BCT. Each line company followed, establishing company perimeters on the eastern border of the maneuver box and preparing to link up with their respective task forces.

Initial linkup between the engineer battalions and the 1st BCT took place on day two, when the 224th TOC tied in with the 1st BCT TOC and the 1st Engineer Battalion. The 224th administrative logistics control center moved into the brigade support area.

Initially, the 224th was involved with three training lanes. After linking up on the ground, the battalion supported three task-force maneuver lanes with one platoon from each company. The intent was to provide engineer platoon leaders from the 224th with an opportunity to plan, coordinate, and synchronize with maneuver commanders. During these combined-arms operations, the 224th conducted movements to contact, deliberate attacks, and deliberate defenses.

While the 224th line platoons provided mobility support, the heavy-equipment operators conducted survivability operations in conjunction with the 1st Engineer Battalion. The 224th's primary digging asset is the D7 dozer while the 1st Engineer Battalion has armored combat earthmovers (ACEs). For the first time, the 224th's operators were able to work with an ACE-dozer team during the construction of two-tier fighting positions, and Y-shaped fighting positions for the 1st BCT.

Internal Training

To maximize training time, the 224th established a training program independent from that of the 1st BCT and the 1st Engineer Battalion. The battalion TOC issued operations orders directing assault-and-obstacle platoons to construct turret and hull-defilade fighting positions for both M1 Abrams tanks and M2 Bradley infantry fighting vehicles. Small emplacement excavators were used to construct crew-served fighting positions at both the brigade TOC and the brigade support area.

The line platoons conducted internal mobility lanes, maximizing training time to conduct category-one tasks from the METL. This was a very resource-intensive training event. Evaluators from the peacetime higher headquarters evaluated the entire orders process. According to the battalion commander's guidance, evaluators focused their attention on troop-leading procedures, rehearsals, and the platoon leader's operations order.

The 224th benefited tremendously from the subject-matter experts provided by the 1st Engineer Battalion in training with the modernized demolition initiator (MDI) and the Volcano. While the 224th had been working with the MDI for the past 12 months, the 1st Engineer Battalion not only provided general instruction but also conducted training on different priming methods. The 224th was able to provide expertise in the siting process, because it had received the Volcano system in March 2000 and had conducted new-equipment training, demonstrated functions tests, and rehearsed system emplacement.

Lessons Learned

During its linkup with the 1st Engineer Battalion and the 1st BCT, the 224th learned some important lessons that should be helpful to other Reserve Component (RC) units when planning training with an AC maneuver unit.

Plan early and synchronize often. The first communication between the 224th and the 1st BCT/1st Engineer Battalion took place 19 months before the training event. Continuous communication on all aspects of the exercise tremendously increased the 224th's preparedness.

Be proactive during preparation for maneuver-force training. The AC maneuver/engineer units dedicate a great deal of time, energy, and resources during their field-training preparation. RC engineers can be either a training enhancement or a detractor, depending on their ability to be proactive during the process. Communicate your expectations and objectives so that the AC understands what you are trying to gain during the training. The 224th's experience was that the AC units were very supportive in helping to reach these goals.

Distribute SOPs down to the squad-leader level. When the 1st Engineer Battalion and 1st BCT forwarded their SOPs, the 224th gave a copy to each squad leader so they would know exactly what was expected when the linkup occurred.

Ensure that the organic training plan is prepared and ready. RC engineers cannot completely depend on AC engineers and maneuver forces to be the exclusive source of training when they link up. The 224th's S3 communicated early with company commanders to ensure that they had training plans and objectives outside the specific missions it was supporting. Commanders with solid plans used their soldiers' time efficiently; those who relied completely on their maneuver force for training were challenged to do likewise.

Do not plan weapons qualification during an integrated annual training. Because of the geographic location of the 224th, training areas that will support crew-served weapons qualification and demolition ranges are limited to the mobilization station at Fort McCoy, Wisconsin. Therefore, the unit normally qualifies on crew-served weapons during its annual training. However, when integrating annual training with an AC maneuver force, it is best to focus completely on the training opportunity at hand and save the crew-served weapons qualification for a weekend of inactive duty for training.

A soldier resupplies Class V for the next mission.

Incorporate the AC leadership into professional-development plans, if possible. The 1st Engineer Battalion commander's presence at and input into the 224th's officer professional-development program really focused the 224th's officer leadership team and validated what it had been discussing for the previous year. If the unit had to do it over, it would request that NCO leaders from the 1st Engineer Battalion participate in an NCO-development program with the 224th NCO leaders during the same month.

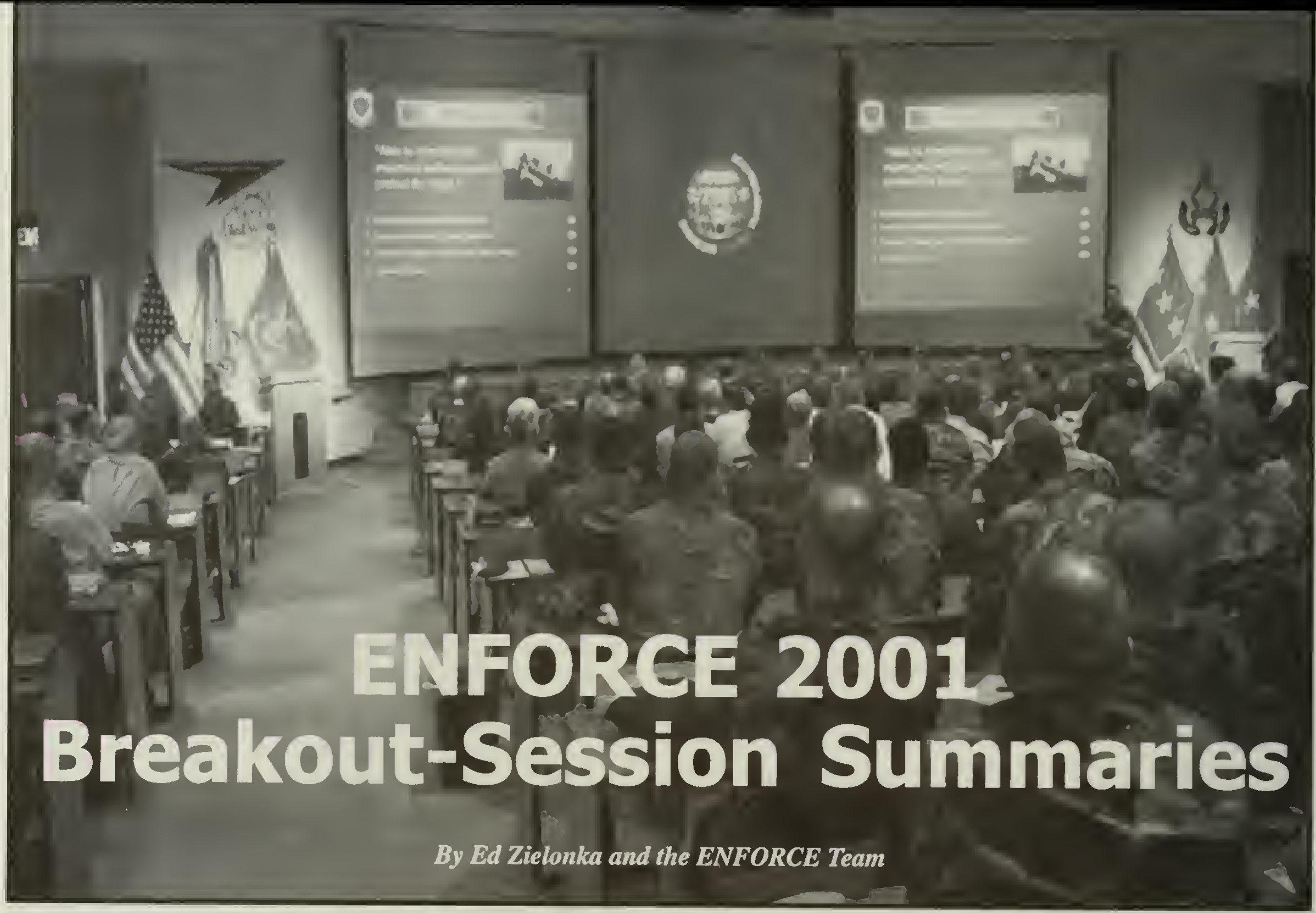
Summary

Integrating RC training with AC units is a mutually beneficial opportunity that should be pursued by RC engineers periodically. Each time we train with the AC, we increase the skills and understanding of all those involved.

There is no question that the officers, NCOs, and soldiers of the 224th benefited from this type of training. Our soldiers now can say that they trained for 2 weeks side-by-side with the 1st Engineer Battalion and the 1st BCT. They understand that even on active duty, training events are not perfect. The AC has many of the same challenges as the RC, such as resource availability and funding constraints. Our leaders were able to integrate with the AC, participate in the orders process at the task-force level, and communicate engineer capabilities with AC maneuver commanders. These communications challenges are issues that we will have to address if we are mobilized, but it is beneficial to first understand the challenges in a training environment.

MAJ Jacobus is the executive officer, 224th Engineer Battalion, Iowa Army National Guard, Fairfield, Iowa.

Photographs are courtesy of Nels Page, a U.S. Marine Corps Vietnam veteran and a volunteer photographer for the 224th Engineer Battalion. Mr. Page is an employee of the Medical Media Services Division, Veterans Administration Medical Center, Iowa City, Iowa.



ENFORCE 2001 Breakout-Session Summaries

By Ed Zielonka and the ENFORCE Team

The ENFORCE 2001 conference in May included a morning devoted to breakout sessions that allowed attendees to contibute to the DTLOMS process in some of the Regiment's most important issues, concerns, and programs that will have an immense impact on the Engineer Regiment during the Transformation. The six sessions from this year's conference are summarized below.

Combat Bridging Requirements

By Lieutenant Colonel Harry Greene

The session provided an opportunity to review the current systems under development in the bridging community and the capabilities these systems will provide on the battlefield. Topics included the current status of the Wolverine, the armored vehicle-launched bridge (AVLB), the heavy dry support bridge (HDSB), and the improved ribbon bridge (IRB) programs and the activation of the multirole bridge companies. Key points of the initial briefing were as follows:

- Of the 132 Wolverines projected, 44 are currently funded.
- A Service Life Extension Program (SLEP) is being proposed for 220 AVLBs under the Army's RECAP program to offset the assault bridging shortage caused by limited funding for the Wolverine.
- Current Department of the Army plans call for a combined total of 352 Wolverines and AVLB-SLEP. Beyond these systems, the Engineer School is reviewing doctrinal and organizational solutions for the remaining requirement.
- The HDSB will be fielded during FY03 to multirole bridge companies at a per-unit ratio of four 40-meter bridges and four launchers. The HDSB has a military load class (MLC) 70/96 capability.
- The IRB will be fielded during FY03 to multirole bridge companies. This is a one-for-one replacement of the currently fielded standard ribbon bridge. The IRB has an MLC 80/96 capability.
- The multirole bridge company conversion is on schedule, with three Active Component and five U.S. Army Reserve units completed. A National Guard company activation is scheduled for this summer.

The following questions were presented for discussion:

Question 1: Given the decrease in the number of Wolverines to be fielded, and the proposal of an AVLB-SLEP, how do we adequately meet the requirements for assault bridging? Currently the AVLB/Wolverine are issued as one launcher, one bridge. Is this the proper ratio to support the force?

Question 2: What is the right mix of assault, support, and line-of-communication (LOC) bridging to fully support the force? Where in the force structure should it be assigned/controlled?

Question 3: How do we transition from assault to support to LOC bridging?

The Engineer School is exploring several courses of action (COAs) to make up for the bridging shortage caused by the loss of funds for the Wolverine program. The breakout session attendees concluded that the Engineer School, in conjunction with the Product Manager-Wolverine, should identify one chassis for the AVLB and develop an AVLB-SLEP to meet the requirements for assault bridging. It was recommended that the assault bridging capability be retained at the division-and-below levels.

Other areas explored and discussed were doctrinal issues associated with the employment of multirole bridge companies and how long an assault or support bridge should stay in place before being replaced with a LOC bridge. Command and control (C2) in the multirole bridge companies must be addressed, as well as the types and number of bridges assigned at the brigade, division, and corps levels. A recommended solution was to issue one additional bridge for each Wolverine and AVLB launcher at the brigade and division levels. Another alternative suggested was to add a third platoon to the multirole bridge company, thus having a full complement of assault, support, and LOC bridging capabilities at the corps level.

Attendees agreed that a study should be conducted to address the assault, support, and LOC bridging requirements and distribution and the level of command for all bridging assets within the force structure to support Transformation of the Legacy Force to the Objective Force. The Engineer School is pursuing funding to conduct this study.

Construction Engineering

By Captain William R. Guevremont III

During this session, representatives from the Active and Reserve Components and agencies of the U.S. Army Corps of Engineers broke into four groups to discuss echelon-above-division (EAD) engineer missions, organization, and allocated equipment. Three of the groups evaluated several COAs to determine the best organizational mix of four current EAD companies, under a battalion headquarters, to perform the following missions:

- **Division:** Missions required in the division area of operations that the division's organic engineer resources cannot execute. These missions were assessed for shortfalls in mobility, countermobility, survivability, and general engineering capabilities that require augmentation with additional construction engineering resources.
- **EAD:** Missions required to support the LOCs and infrastructure in support of division operations and extending through to the corps operational area.
- **Echelon above corps (EAC):** Missions required to open and maintain sea and aerial ports of debarkation and the infrastructure feeding into the corps.

The fourth group discussed prioritization of construction-engineer equipment, using a wide range of criteria to determine what equipment is the "core" of the construction force, the pieces least used, and strategic deployability.

The results and recommendations of these four groups are as follows:

- The organizational mix for the divisional group was one mechanized engineer company, one combat heavy company, one combat wheel company, and one combat-support-equipment company. The Engineer Division, Directorate of Combat Developments (DCD), MANSCEN, is evaluating a concept that incorporates a multirole bridge company to provide bridging in support of division operations.
- The organizational mix for the EAD group was two combat heavy companies, one combat wheel company, and one combat-support-equipment company.
- The organizational mix for the EAC group was two combat heavy companies, one combat-support-equipment company, and one construction-support company. However the group also recognized certain advantages in retaining a "plug-and-play" capability for EAC battalions (for example, replace the construction-support company with a port-construction or pipeline company for specific missions).
- The discussion/review of equipment produced several ideas for increased efficiencies that include leveraged engineer-group consolidated assets and the potential for leasing low-density equipment.

The next stage of this ongoing effort for Engineer Transformation is to produce detailed concepts for worldwide staffing.

Geospatial Engineering

By Lieutenant Colonel Steve Tupper

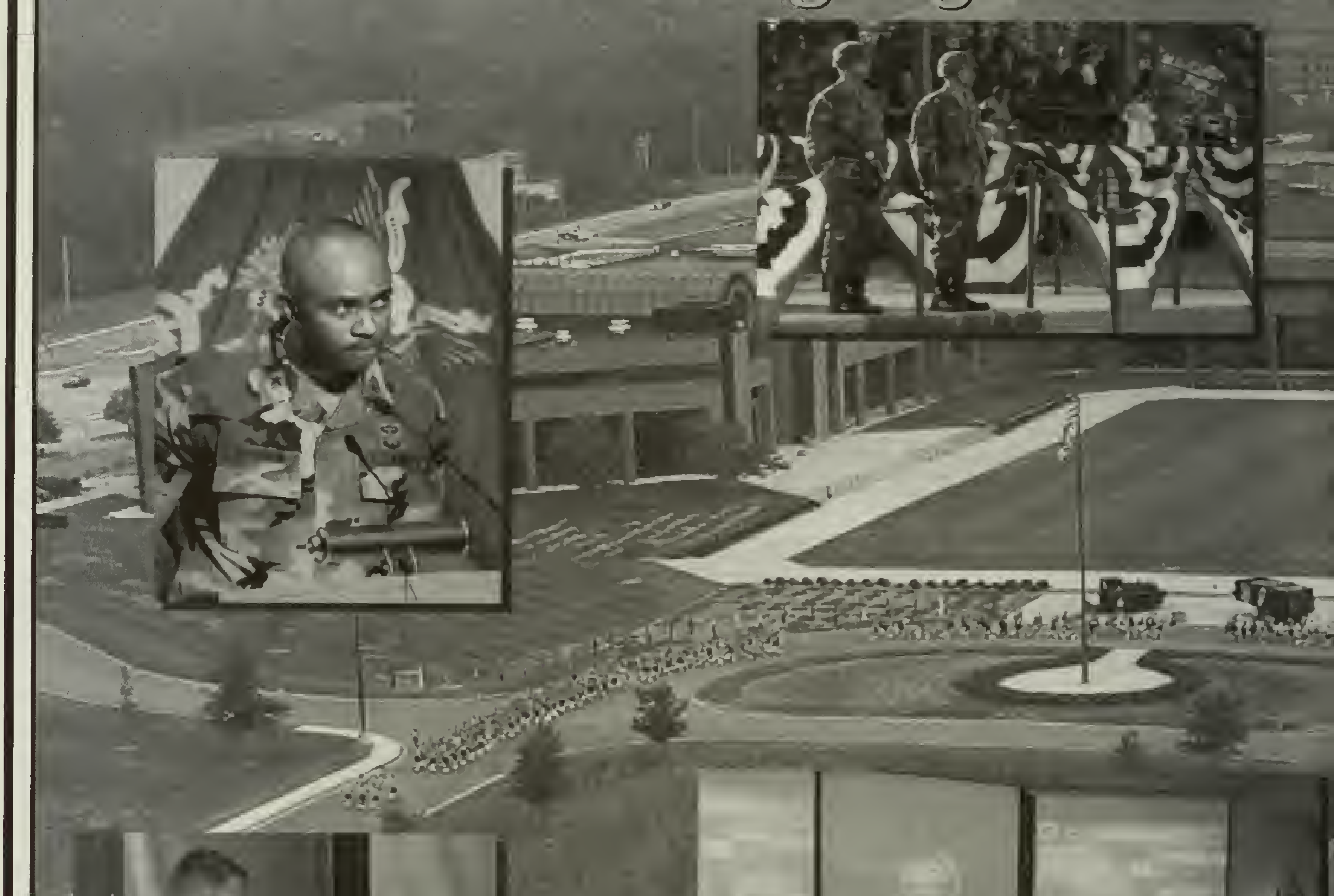
This session was designed to gather and consolidate suggestions for the National Imagery and Mapping Agency (NIMA) terrain data and product requirements process. The session followed the address given by the NIMA Director to the Regiment's leadership concerning the support NIMA provides to the Department of Defense. U.S. Army engineers help drive the procedures that Army forces use to secure the terrain data that major tactical units and their terrain teams use to support the field. The requirements process includes ordering and delivery information.

Breakout session attendees agreed on several key points:

- The Army needs a simple, step-by-step, comprehensive, consolidated set of instructions—not a series of uncoordinated guidance.
- The Defense Logistics Agency (DLA) or NIMA must create an interface between the NIMA Gateways (secure Internet Web sites for ordering data) and the DLA Web site for ordering and shipping.

(Continued on page 38)

ENFORCE 2001 Highlights



ENGINEERS
"Engineers Leading Transformation"

(Geospatial Engineering, continued from page 35)

- Users need feedback from the NIMA system that reports exactly what has been ordered, how large the product is for electronic storage and shipping, and how long it will take for delivery.
- Some orders will be for existing products while others generate new production. The responsibility for filling requests for existing products remains with DLA. The responsibility for new production lies with NIMA. This split should not affect the user.
- The chief of the TRADOC Program Integration Office-Terrain Data showed a draft geospatial product-request form that was created using Microsoft® Access®. Attendees recommended several modifications to the form.
- Army units desiring NIMA data should consider their orders for Mission-Specific Data Sets (MSDS) as a starting point for negotiations with the NIMA Customer Support Team (either the Army team or a CINC support team). The team will advise the customer on the data available that NIMA can gather or generate by the requested date.

The session ended with the positive feeling that NIMA is moving in a direction that is advantageous to the Army's long-term interests. Over the next few years, NIMA will—

- End production of 1:50,000-scale maps.
- Increase the holdings of foundation data.
- Drive services to request MSDS.
- Build the commercial joint mapping tool kit to view the data on the Army Battle Command System.

This transition may be difficult, so beginning the transition now is smart. The ongoing exercise schedules, automated C2 systems integration, and the Army Transformation give an opportunity to make these changes outside of actual operations. The Army has an early voice in defining future requirements, and engineers are leading the Army's Transformation in this aspect.

IBCT/IDIV Engineers

By Major Ronald Condon

This session focused on taking a firsthand look at the engineer units in the Interim Brigade Combat Team (IBCT) and Interim Division (IDIV) and recommending changes—across doctrine, training, leader development, organization, materiel, and soldiers (DTLOMS)—to help ensure optimal bang for the buck. This is an area we must "get right the first time." The personnel attending this breakout session discussed—

- The operational environment. Its characteristics include—
  - Distributed and simultaneous operations.
  - Limited or poorly developed infrastructure.
  - Noncontiguous battlefield.
  - Complex terrain, to include a wide range of operating conditions.
- The threat concepts and capabilities. The threat—
  - Will marginalize the U.S. high-tech advantage via asymmetric operations.
  - Can employ military forces where and when it chooses.
  - Can accept "not losing" as a strategic goal.
  - Can support a prolonged conflict in the contested area.
  - Will deny U.S. access and limit tactical mobility through extensive use of mines and chemical-biological agents.
  - Is modernizing in light of late twentieth-century lessons.
  - Can counter with sufficient mass and technology to inflict highly visible and embarrassing losses.
- The IBCT Operational and Organizational (O&O) Concept and the Engineer Battlefield Functional Area (BFA) Assessment. The organic IBCT engineer company—
  - Is optimized to provide mobility support to maneuver battalions.
  - Provides limited survivability and countermobility support.
- The IDIV O&O Concept. The IDIV—
  - Is full-spectrum capable.
  - Will have three IBCT-like combat formations.
  - Uses current "off-the-shelf" technology and platforms.
  - Is the bridge to the Objective Force.
  - Is an early-entry force (simultaneously deploys and shapes; is decisive earlier).
- The engineer IBCT and IDIV engineer BFA O&O requirements versus capabilities. Attendees—
  - Analyzed the DTLOMS impacts.
  - Identified risk/excess capability for IDIV O&O mission-essential tasks.

Although the session did not allow enough time to answer all of the outstanding issues, it did provide a venue for engineer commanders to understand the issues and provide recommendations for the design of the IDIV engineer organization. All participants agreed that the current engineer-force structure was too small to effectively support the IDIV mission sets. They further agreed that—because of the complex operations and the environment—an engineer colonel is needed to command the IDIV engineer organization. Three possible IDIV engineer organization courses of action (COA) were discussed:

COA 1: The working engineer group or regiment. This COA consists of a group or regimental headquarters (commanded by a colonel) and five companies:

- Three IBCT engineer line companies (typically directly supporting each IBCT).
- An "IBCT-like" general support sapper company (provides close combat support to weight the IDIV main effort).
- A construction engineer company (provides general support to the division—similar to a light equipment company).

COA 2: An engineer group or regimental headquarters with two subordinate engineer battalions:

- A battalion headquarters consisting of the three IBCT companies and an "IBCT-like" general support sapper engineer company.
- An engineer battalion consisting of an IBCT-like general support sapper engineer company, a "corps wheel-like" engineer company, and a corps light horizontal equipment construction company.

COA 3: An engineer group or regimental headquarters and one subordinate engineer battalion:

- A regimental headquarters commanding an IBCT-like general support sapper engineer company, a corps wheel-like engineer company, and a corps light horizontal construction engineer company.
- An engineer battalion consisting of three IBCT engineer companies and an IBCT-like general support sapper engineer company.

The breakout session attendees agreed to recommend COA 2 to the commanding general: Increase the engineer force structure and ensure that it supports the growth of future IDIV engineer group or regimental and battalion commanders. The Engineer School continues to analyze the best force-structure mix for the IDIV engineer organization and will validate the engineer requirements in upcoming IDIV rock drills before finalizing the IDIV O&O on 1 March 2002.

Mine/Countermine

By Colonel John Holler

This session consisted of brief presentations on the evolution of mine and countermine (M/CM) systems and highlighted Engineer School efforts for the future. Engineer leaders, materiel developers, combat developers, and contractors discussed doctrinal and materiel efforts affecting future M/CM systems. The following topics were discussed:

- For political reasons, it may be advantageous to stop referring to systems as "mines" (particularly the "smart" ones) and change the terminology to "munitions."
- C2 systems must do a better job of tracking and portraying mine/munition locations. These systems must display exact locations of individual mines or exact boundaries of fields to Force XXI Battle Command, Brigade and Below (FBCB2). A challenge exists in passing information between differing digital systems or in integrating echelons above division or other units not possessing digital or compatible C2 systems. There are too many manual or "swivel-chair" work-arounds in use.
- Commanders in the field would be much better served if we could modify the Volcano system to allow self-destruct times to be reset and add a command-detonation feature. Currently, maneuver commanders are reluctant to use anything beyond a 4-hour self-destruct time. They view even 48 hours as too long a commitment. The 4-hour self-destruct time severely impacts the engineers' ability to shape the battlefield. They must closely assess decision and trigger points when executing a system that begins its self-destruct cycle in less than 4 hours. A reset feature would allow commanders to lengthen effects, and a command self-destruct—or better yet a render-safe—feature would allow friendly forces to pass without having to breach our own minefields. If these features cannot be incorporated into the Volcano, they must be features of any future mine systems.
- Future mines must all have a capability to identify friends and foes or have a remote on-off-on feature. We need these technologies to minimize fratricide. Also, future emplaced mine/munition fields should have a warning technology to alert errant friendly forces that they are approaching a danger area. Electronic or visual warnings on C2 systems and "in the clear" must be used. These warnings need to be effective for both digitized and nondigitized forces.
- We may need to look at using mines without an explosive fill—nonlethal and other technologies. Perhaps we can fulfill the role of mines with systems that attack the electronic components of a vehicle or its engine—or with a technology that attacks some other part of a vehicle that prevents it from moving or prevents the occupants from controlling or using the vehicle.
- It is time to reconsider our classification of minefield locations. Currently, the location of minefields and even individual mines is classified as "Secret." This leads to serious challenges with the new "smart" mines/munitions that self-report their locations and other information to remote-control stations.
- Senior leaders have questioned our continued need to use "brute-force" breaching systems. Currently, some form of brute-force breaching may be the only way to deal with certain mine threats. These systems, by necessity, will remain a viable part of our countermine capability. Additionally, searching for a single "silver-bullet" technology is too optimistic. Our countermine success will continue to be tied to several systems, each of which provides a specific but limited capability.
- We currently are developing precision standoff detection and neutralization approaches to the countermine problem. A more beneficial option may be to develop an area-neutralization capability. If we can neutralize mines over a wide area instead of focusing on precise neutralization, we can eliminate the need to conduct precise mine detection.

These comments are all well founded and must be considered by all that are developing the future M/CM systems and doctrine for our Regiment and Army.

Officer Development

By Lieutenant Colonel Susan Myers

This session provided the Regiment with information concerning the transformation of the Engineer Officer Basic Course (EOBC) to the Basic Officer Leader Course (BOLC) Phases I and II in fiscal year 03. The purpose of this change is to produce leaders with character and competence who are self-aware and adaptable and act to achieve excellence. This initiative is being directed by the Training and Doctrine Command and will repackage the current EOBC 17-week course to a 20-week course.

The first 7 weeks of the BOLC Phase I will take place at Fort Benning, Georgia. This course will be a mix of officers from all branches and will focus on leadership development. Course material includes tactics, leadership, doctrine, counseling, weapons qualification, land navigation, physical training, and situational tactical exercises. Common-core instruction includes maintenance, preventive medicine, air defense, and communication skills. Approximately 76 percent of the instruction will take place in the field and the remaining 24 percent in the classroom.

To graduate from BOLC Phase I, all lieutenants will meet height/weight standards, pass the Army Physical Fitness Test, perform satisfactorily in leadership requirements (counseling, peer evaluations, and cadre assessments), qualify with the M16A2 or M4 rifle, complete 4- and 6-mile foot marches, and run 3 miles in less than 27 minutes in formation. Other skills will include combat water survival, running 4 miles in less than 36 minutes, completing 8-mile foot marches, and passing basic land navigation (day and night) and a leadership exam from FM 22-100, *Army Leadership*.

The second phase of BOLC—or BOLC II (Engineer)—which is at Fort Leonard Wood, Missouri, will be similar to the EOBC program of instruction that is currently being taught. There will be some course reductions because of time constraints. Most of the common-core subjects will emphasize engineer systems, combat engineering, tactics, and construction skills. The combat-engineering instruction will focus on the task-force-engineer operations-order process, mine warfare, bridging, reconnaissance, demolitions, target folders, breaching operations, engineers in military operations in urban terrain (MOUT), obstacle tactics, and engagement-area development. The construction subjects will include project management, structures, utilities, concrete, survivability positions, drainage, airfield-damage repair, and road/airfield construction. Some of the subjects that will be deleted are Bailey-bridge design, the river-crossing practical exercise, and equipment training.

Some of the issues raised during ENFORCE were scheduling of the courses so the Reserve Component officers have some flexibility in working their schooling with their careers, minimizing duplication of subjects taught in other schools, and making course material available online. The Engineer School is continuing to train our future leaders to be a vital part of the combined-arms team. We appreciate your feedback and look forward to your support of the Engineer BOLC.

Officer Retention

By Lieutenant Colonel Mike Helmick

The purpose of this breakout session was to educate the engineer leadership on retention challenges and develop proposals on how the Engineer Regiment can improve engineer-officer retention.

During the session, information was presented on the Army's initiatives to retain company-grade officers and its efforts to man the force. These initiatives included expanding educational opportunities, increasing assignment choices to better accommodate officer preferences, and providing better communication to the field. During the session, senior leaders also discussed an initiative by the U.S. Army Corps of Engineers to provide junior officers opportunities to work in local engineer districts as part of a junior-officer intern program.

Breakout-session discussions included the following topics:

- The need to balance assignments to minimize the impact on the family.
- The changing Army demographics. A higher percentage of spouses work and have professional careers, which creates a need for more stability and a better support system for families.
- The fact that married couples in the service are leaving the Army together.
- That commanders should do all they can to help retention. Officers frequently say that the senior leadership is one of the reasons they are leaving the Army.
- The Army met its goal for the Active Duty Recall Program for captains.
- Encouraging officers to switch from Active Component to Reserve Component, or vice versa, to retain quality officers in the total Army.

There is no single reason why officers leave the Army, and there is no one solution for improving retention. However, each leader can positively impact retention by actively participating in senior-level discussions and providing direct leadership to junior officers.

Conclusion

This year's breakout sessions provided a valuable platform for senior leaders to discuss some of the most important subjects facing the Engineer Regiment. Some very critical issues were raised and addressed. Session notes are being finalized and will be forwarded to the ENFORCE coordinator for further action as necessary.

Where Is the MTOE Guy?

Recommendations for the Combat-Engineer Company (Heavy Division) MTOE

By Captain Edward P. Chamberlayne

On 17 October 2000, a new edition of the modified table of equipment (MTOE) went into effect for the mechanized combat-engineer battalions. Over the years, the MTOE has been pared down at a considerable savings. As an officer in combat-engineer battalions, I have been frustrated with the inadequacies of the MTOE. In this article, I list the items, by priority, that I believe could improve the readiness and combat ability of the combat-engineer company. I list dollar amounts, when possible, to justify the additions and deletions to the MTOE. Where appropriate, I include a table that summarizes the current MTOE and my recommendations. The prices, which are based on the March 2000 FEDLOG CD-ROM set distributed by the Defense Logistics Agency, are an attempt at quantifying the changes and are not intended to be a complete statistical analysis of the MTOE. My intention is to generate discussion between the combat-engineer battalions and then provide feedback to the Engineer School to the desk of the MTOE guy.

Armored Combat Earthmover (ACE)

Recommendation: Change the MTOE to five ACEs and two D7G bulldozers with M916 prime movers and M870 trailers.

Engineers know or have heard about the problems with the ACE. It is a great concept—combine the digging capability of the D7 bulldozer with the speed, mobility, and armored protection of an M113. This concept is not a reality yet, but the systematic improvement plan for the ACE is continually improving the vehicle. It is good for breaching, digging protective berms, and pushing soil. But for constructing hull or turret defilade vehicle fighting positions in rocky or clay-rich soil, you need something more durable—the D7G with rippers. We had D7Gs until the ACE arrived. What I recommend now is a mix—five ACEs and two bulldozers. This would allow the commander to task-organize for the defense, offense, or stability and support operations. This will also give the combat-engineer commander the ability to improve roads and construct hasty trails for the maneuver commander.

Incorporating the D7G bulldozer will mean a savings for the combat-engineer company (see Table 1). This recommendation assumes that the person will operate the M916 prime mover and the D7G. A cost that is not included in this proposal is the maintenance of the ACE versus the D7G. However, eliminating two ACEs will save a significant amount of money on Class IX repair parts.

High-Mobility, Multipurpose Wheeled Vehicle (HMMWV)

Recommendation: Add one M998 HMMWV to the MTOE for the first sergeant.

It seems that every first sergeant in every combat unit on the battlefield has a vehicle except the combat-engineer first sergeant. I believe that he needs a cargo HMMWV so he can inspect training, deliver Class I supplies to soldiers, deliver Class IX repair parts, deliver/pick up mail, conduct casualty evacuation, and so on. Some would argue that the 5-ton or the 2 1/2-ton truck in the headquarters platoon is available. However, the supply sergeant and supply clerk use the 5-ton truck , and the prescribed-load-list (PLL) clerk uses the 2 1/2-ton truck. A vehicle for the battalion command sergeant major and battalion executive officer was just added to the MTOE, so I recommend one for the first sergeant. The cost would be about $34,735.00.

Combat Engineer Vehicle (CEV) and Personnel

Recommendation: Reinstate the two staff-sergeant positions and a cargo HMMWV.

In 1996, the combat-engineer company lost two CEVs and eight personnel, according to the revised MTOE. I think this was done to save money on repair parts, prepare for the fielding of the Grizzly, and improve unit manning (about 504 engineers [12B]). This created a significant void in our mobility-support capability. The other impact was the loss of two of the three

Current MTOE			
Vehicle	**Quantity**	**Cost per Unit**	**Total**
M9 ACE	7	$887,050.00	$6,209,350.00
Changed MTOE			
Recommended Vehicles	**Quantity**	**Cost per Unit**	**Total**
M9 ACE	5	$887,050.00	$4,435,250.00
D7G Bulldozer	2	$241,642.00	$483,248.00
M916 Tractor	2	$69,310.00	$138,620.00
M870 Trailer	2	$20,007.00	$40,014.00
		Total	$5,097,168.00
		Total Savings	$1,112,182.00

Table 1. Recommended Vehicle Changes

squad leaders in the assault-and-obstacle (A&O) platoon. The platoon was broken into two assault sections—each led by a staff sergeant who was also the tank commander for the CEV—and an obstacle section. The most senior armored vehicle-launched bridge (AVLB) tank commander—usually a junior sergeant who must lead his soldiers and peers—is now the squad leader. This creates a void of leadership in the A&O platoon. It is the most maintenance-intensive platoon in the company, yet it has the most junior noncommissioned officer (NCO) leadership. This does not set the platoon up for success. Consequently, if we add the squad leaders, then we should add a vehicle for them (see Table 2).

FY96 MTOE			
Vehicle/Personnel	**Quantity**	**Cost per Unit**	**Total**
CEV	2	$676,796.00	$1,353,592.00
12B30	2		
12B20	2		
12B10	4		
Changed MTOE			
Recommended Vehicle/Personnel	**Quantity**	**Cost per Unit**	**Total**
M998 (cargo)	2	$34,735.00	$69,470.00
12B30	2		
		Total Savings	$1,284,122.00

Table 2. Recommended Vehicle Additions

Communications Equipment

Recommendation: Upgrade the radio configurations.

Communication with the soldier in the field has always been a challenge. The recent MTOE change was a positive one—every vehicle in the engineer company is now authorized a radio system. However, most of the vehicles need long-range capabilities since an engineer company can be spread across a task force or even a brigade during combat operations. Thus, recommend that every radio in the vehicles be able to talk long range and that leaders be able to talk on at least two radios at long range. Adding a power amplifier to the existing radio system—a cost of about $921.00—could solve this problem. Table 3 lists the recommended changes by vehicle type in a combat-engineer company.

AN/PVS-4 Night Sights and M203 40-mm Grenade Launchers

Recommendation: Add 2 more AN/PVS-4 night sights and authorize the company to carry 12. Add 2 more M203s to the MTOE and authorize the company to carry 6.

Current MTOE				
Vehicle	**Radio System**	**Description**	**Quantity**	
M60 Tank	AN/VRC-87D	SR	4	
M9 ACE	AN/VRC-87D	SR	7	
HEMTT	AN/VRC-87D	SR	2	
Squad M113	AN/VRC-88D	SR w/dismount kit	6	
Platoon sergeant HMMWV	AN/VRC-88D	SR w/dismount kit	2	
A&O platoon sergeant M1038	AN/VRC-90D	LR	1	
Platoon leader M113/M1038	AN/VRC-91D	SR/LR w/dismount kit	3	
Commander's vehicle/M577	AN/VRC-92D	LR/LR	3	
M548 Volcano	AN/VRC-87C	SR	2	
First sergeant HMMWV	None	N/A	1	
Assault section HMMWV	None	N/A	2	
Supply 5-ton	AN/VRC-89D	SR/LR	1	
PLL 2 1/2-ton	AN/VRC-89D	SR/LR	1	
SEE truck	AN/VRC-89D	SR/LR	2	
Changed MTOE				
Vehicle	**Recommended Radio System**	**Description**	**Upgrade Cost per Unit**	**Total**
M60 Tank	AN/VRC-90D	LR	$1,069.00	$4,276.00
M9 ACE	AN/VRC-90D	LR	$1,069.00	$7,483.00
HEMTT	AN/VRC-90D	LR	$1,069.00	$2,138.00
Squad M113	AN/VRC-91D	SR/LR w/dismount kit	$10,730.00	$64,380.00
Platoon sergeant HMMWV	AN/VRC-91D	SR/LR w/dismount kit	$10,730.00	$21,460.00
A&O platoon sergeant M1038	AN/VRC-91D	SR/LR w/dismount kit	$10,071.00	$10,071.00
Platoon leader M113/M1038	AN/VRC-92D	LR/LR	$2,011.00	$6,033.00
Commander's vehicle/M577	No change			$0.00
M548 Volcano	AN/VRC-90C	LR	$1,069.00	$2,138.00
First sergeant HMMWV	AN/VRC-92D	LR/LR	$21,238.00	$21,238.00
Assault section HMMWV	AN/VRC-90D	LR	$13,178.00	$26,356.00
Supply 5-ton	No change			
PLL 2 1/2-ton	No change			
SEE truck	No change			

Table 3. Recommended Radio-System Changes

LIN	Nomenclature	Cost per Unit	Quantity	Subtotal	Remarks
B49004	Bayonet	$79.04	24	$1,896.96	71 M4s and M16s means 24 excess bayonets
B84404	RB3 recon boat	$1,207.00	2	$2,414.00	Not used
G66776	Driver proj powder actuated	$395.85	2	$791.70	Not used
M60449	Multimeter	$130.00	1	$130.00	Used and needed but not authorized
L44595	M203 grenade launcher	$593.00	8	$4,744.00	Reduced from 12 to 4
P06148	PLT early-warning system	$8,312.00	2	$16,624.00	Not used and obsolete
R93169	AN/PRM-34 radio test set	$932.00	1	$932.00	Used and needed but not authorized
T63238	Sketch set	$690.04	2	$1,380.08	Not used
W48074	Platoon pioneer tool kit	$3,891.49	1	$3,891.49	Not used—already removed from MTOE
W34511	Platoon carpenter tool kit	$1,404.03	1	$1,404.03	Not used—already removed from MTOE
X11320	Transit pocket clinometer	$164.55	2	$329.10	Not used
W37483	TK-101 commo SPC tool kit	$976.00	1	$976.00	Used and needed but not authorized
	M9 ACE and dozer-mix idea			$1,112,182.00	Changed to 5 ACEs and 2 D7G dozers
	First sergeant's HMMVW idea			-$34,735.00	Give first sergeant a HMMWV!
	Assault-section squad-leader idea			$1,284,122.00	Give squad leaders HMMWVs
	Radio-upgrade idea			-$165,573.00	More radios means better communication
	M203 and AN/PVS-4 idea			-$6,864.00	Allocate the weapons and night sights better
	Company commo-section idea			-$2,038.00	Bring back the 31U10 and tools
	PLL-section idea			-$8,524.00	Establish company PLL and give M105 trailer
		Total Savings		$2,214,083.36	

Table 4. Summary of Recommended Changes to the MTOE

The MTOE change reduced the number of AN/PVS-4 night sights to 10. These sights are used with the M249 squad assault weapon (SAW) and the newly fielded M240B machine gun. Currently, the MTOE has eight M249 SAWs and four M240B machine guns. Therefore, we need two more AN/PVS-4 night sights to be effective. Before the latest update to the MTOE, we had two M203s per squad (12 total in the company), which the team leaders normally carried. The current authorization is four per company. I believe the absolute minimum should be one per squad, assigned to the squad leader. The cost would be about $6,864.00

Communication Personnel

Recommendation: Reassign one military occupational specialty (MOS) 31U10 and reinstate the TK-101 communication specialist tool kit, multimeter, and AN/PRM-34 radio test set.

As of 17 October 2000, the 31U10 MOS and the TK-101 were no longer authorized. Engineer companies are designed to support mechanized and armored task forces, but they also operate independently. The Single-Channel Ground-to-Air Radio System (SINCGARS) equipment is more complicated when troubleshooting defective radios and installation kits in the tracked vehicles. The company needs a 31U10 to troubleshoot the internal intercom systems, power-junction boxes, and combat-vehicle-crewman helmets. We also need the diagnostic tools such as the multimeter and AN/PRM-34. The cost would be about $2,038.00.

Company Prescribed Load List (PLL)

Recommendation: Reassign one MOS 92A10 (PLL clerk) to the MTOE of each company and add an additional M105A2 trailer.

The engineer battalions are not authorized enough 92A10s to operate a Unit-Level Logistics System-Ground (ULLS-G) computer (or box) for each company. If we are to maintain our equipment properly, keep the equipment at -10/-20 standards, then we must be authorized the 92A10. Forcing the engineer company to train 12B10s to do the job takes away from our total engineer capability and prevents a soldier from continued engineer training.

Engineer squads use the M105 trailer to move the equipment that does not fit in the squad M113s. A seventh trailer, which is used to move equipment for the company headquarters M577, is authorized. The company needs an additional trailer to move equipment behind the 2 1/2-ton for the company PLL. The cost would be about $8,524.00.

Conclusion

We are constantly challenged to face various missions on a daily basis. Let's design an MTOE that helps the soldiers face these missions more effectively and efficiently. Table 4 is a summary of the changes I recommend to the MTOE. We must remain flexible to adapt to new missions; having the proper equipment and personnel will allow us to do this better. I would like to encourage more discussions about our MTOE, suggest ideas on how to improve it, and make an impact on our future readiness.

Please send feedback regarding this article to *edchambe@vt.edu.*

Captain Chamberlayne just left company command of C Company, 70th Engineer Battalion at Fort Riley, Kansas. He has served as platoon leader, company executive officer, S3 operations officer, and assistant brigade engineer in mechanized engineer battalions. He is currently assigned to the U.S. Army Student Detachment while in graduate school at Virginia Tech.

Cave Demolition

By First Lieutenant Scott Swilley

From 2 June to 10 December 2000, Alpha Company, 16th Engineer Battalion, Giessen Army Depot, Germany, was deployed to Camp Monteith, in Kosovo, to help maintain a safe, stable, and secure environment for the people of Kosovo. The company supported the Task Force 1-36 Infantry sector by managing eight towns and monitoring the provisional boundary. In addition, the company conducted on-order missions out of the sector to apply its engineer-specific skills. In early November, the task force called on those skills.

As winter approached, caves were being discovered in the mountainous southeastern part of Kosovo—one of them in the Task Force 1-36 Infantry sector. The task force had learned that a cave also had been discovered in the Polish sector and, after the entrance was cleared, multiple antipersonnel mines with trip wires were found. Additionally, the cave contained a weapons cache, a much-earlier victim of a booby trap, chemical fuses, and a gas mask for a horse. This indicated the age and diversity of the cache and suggested the possibility of a chemical threat associated with caches in remote areas. Alpha Company's 1st Platoon was tasked to clear and seal the cave in the Task Force 1-36 Infantry sector and provide command and control of additional assets, as necessary. This article relates the events surrounding the demolition reconnaissance, hypothesis, and execution and the lessons learned.

Reconnaissance

Key leaders from the platoon, an explosive ordnance disposal (EOD) team, and a security detail from Alpha Company, 3/327 Infantry, which owned the sector in which the caves were found, went into the hills to conduct a reconnaissance of the cave. The route leading to the cave—about 15 kilometers of dirt road containing potholes and extremely sharp curves—was untrafficable to vehicles with long wheel bases (such as heavy expanded-mobility tactical trucks [HEMTTs], dump trucks, and mix trucks). After arriving on-site, the infantry secured the area, and sappers in mission-oriented protective posture (MOPP) Level 1 gear used AN/PSS-12 mine detectors to sweep a path to the entrance of the cave, while scanning for signs of booby traps. Once a path had been cleared, a left and right handrail was emplaced using high-visibility tape.

Sappers from 1st Platoon were then ready to begin gathering critical dimensions of the cave for a potential demolition mission. Before they could determine the inside diameter, they had to clear several feet into the cave. First, they visually inspected with a flashlight from a cleared position and then grappled into the cave as far as possible from behind a berm a few meters from the entrance. Once this was completed, the dimensions could be collected.

1st Platoon sappers discovered that the average interior diameter of the cave, which extended into the hill approximately 75 meters, was 5 feet. There were no abrupt changes in direction in the cave, and it was level with the horizon. Although the cave appeared to be constructed by man, there was no evidence of spoil or means for spoil removal. The hill that the cave extended into resembled granite in appearance, strength, and hardness.

Hypothesis

After collecting the critical dimensions and the necessary information for the demolitions reconnaissance report, the recon team members returned to Camp Monteith to formulate their plan of attack. They established design criteria based on two demolition techniques.

The first technique was based on a combination of the Methods I and II attack on an arched, closed-spandrel, masonry bridge. Essentially, the structural integrity of the cave would be destroyed by placing a charge on each wall and one on the ceiling to create the necessary spoil to seal the cave. These three charges formed one firing system.

The second demolition technique used the premise of counterforce-charge demolitions. The challenge would be to create the required amount of spoil to seal the cave, while taking into account the amount of rock that would be pulverized into inadequate sealing material. The solution was to create a counterforce shock wave by placing three equally spaced firing systems in the cave and detonating them simultaneously. The theory was that the shock wave from the two outer charges would collide with the shock wave from the inner charge and force the inner charge to penetrate to a much greater depth, causing a larger volume of material to be displaced. If too much force was generated, material could be blown from the cave, creating a large crater and subsequently a second entrance to the cave from above. These were the premises that were the foundation for the design of the charges.

The charge design was based on calculations in Field Manual 5-250, *Explosives and Demolitions,* for breach charges attacking rock. Taking into consideration the dimensions of the cave and the volume of material necessary to be produced plus the void created by rock pulverization, a 7-foot breach charge was selected. This amounted to 118 packages of C4 explosives per breach charge, 354 packages per counterforce charge, and 1,062 packages for the firing system—or 1,327.5 pounds of C4 to be detonated simultaneously (see Figure 1).

When Alpha Company personnel contacted the Engineer School to verify the method and amount of demolitions, they learned that there was no doctrine for this type of operation. Basing their answer on demolitions for quarrying operations, school personnel suggested boreholes as the preferred technique. However, it was not possible to drill boreholes, and explosive boreholes were not an option because of the possibility of a cave-in when reentering the cave after demolitions had been executed inside. The school personnel concurred with the platoon's assessment of the situation.

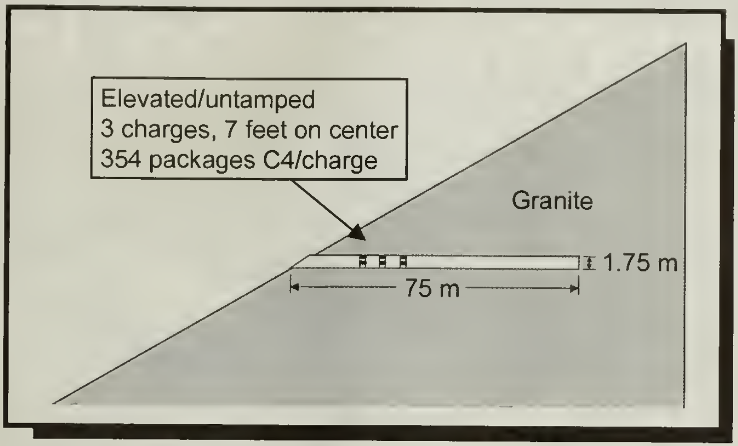


Figure 1. Cross-Sectional View of Cave and Charge Placement

Executing the Mission

After coordinating with EOD, security, and medical-evacuation personnel, the platoon was ready to execute the mission. Because of the route conditions, Class V materials had to be shuttled to the site via a cargo HMMWV. Once the platoon reached the cave, it reestablished security, cleared and marked a lane to the entrance of the cave, and cleared a space for preparing the demolitions.

One platoon member and a soldier from the EOD team entered the cave to look for booby traps and caches. Since the cave surfaces were solid rock, there was no place to bury or camouflage booby traps, so the soldiers could visually clear the cave by using a flashlight. Moving deliberately through the cave, the two soldiers scanned all sides for anything unusual before proceeding. The clearing operation took approximately 30 minutes, and no booby traps or caches were found.

Thirty-seven cases of C4 explosives were shuttled up to the site along with the Class IV materials. To enable the charges to be placed against the sides and ceiling of the cave, platforms were constructed which would allow proper contact between the explosives and the cave surface. Figure 2 shows the placement of the charges. In addition, a crawl space was created where sappers could prime the charges once they had all been placed.

To obtain a counterforce effect, all charges had to be simultaneously detonated, so an interesting problem was posed. Due to the confinement of the cave and the amount of charges, a dual-fired system consisting of British junctions was not a feasible solution. A modernized demolition initiator (MDI) would have to be used to ensure a simultaneous detonation. However, it had to be verified that all the M11 shock tubes used to prime the explosives were the same length from the charges to the shock-tube consolidation point, care had to be taken to not rupture the shock tubes in the confined and rocky environment, and accountability of M11 shock tubes had to be maintained to ensure the integrity of the two firing systems.

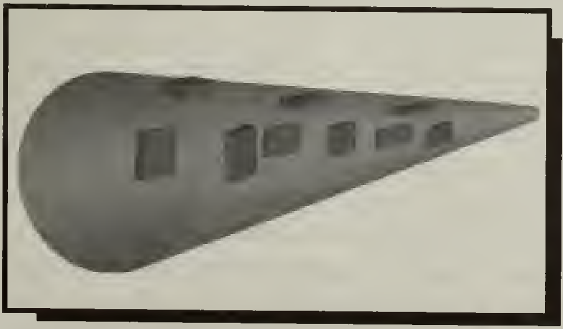


Figure 2. Perspective View of Charge Placement

The MDI system worked very well. Two M11 high-strength blasting caps and shock tubes were used to prime each charge. An M11 from each charge was run to a central location, which ensured that all shock-tube lengths were equal. At that point, two M9 bunch blocks per firing system were used to consolidate the M11s, and two additional M11s were run out of the cave and tied into two series of M13 low-strength blasting caps with 1,000 feet of shock tube. This firing system would provide the necessary redundancy and ensure simultaneous detonation.

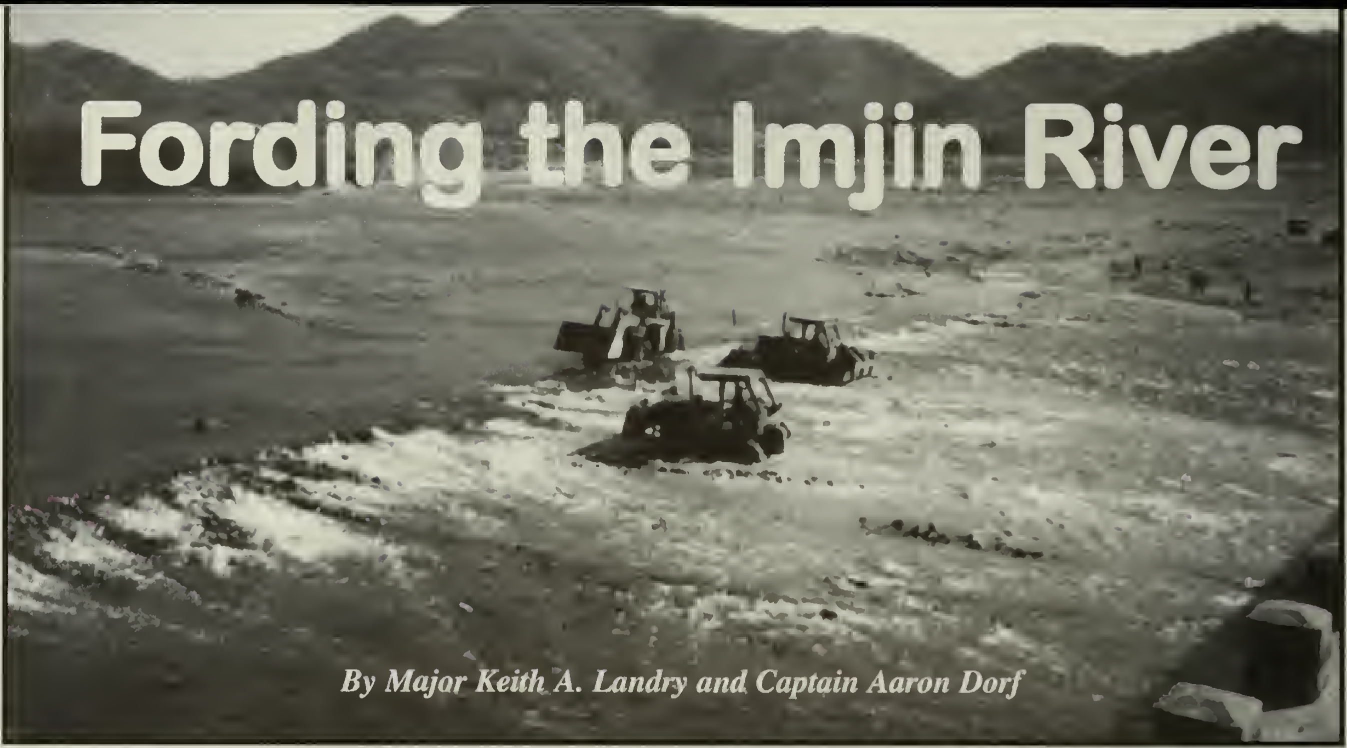
The demolition was executed and the desired effect achieved—the entrance to the cave was sealed by a massive amount of material, and the cave collapsed. This was evident by a depression in the hillside that extended along the route of the cave.

Lessons Learned

During this operation, the platoon learned demolition calculations and theory for cave and tunnel demolitions. It also learned the importance of continuing to maintain proficiency in wartime, individual engineer-specific tasks. Although the calculations worked in this case, a more detailed study would be required for developing doctrine on this subject. In addition, entering and clearing the cave was an engineer job that had not been performed recently. However, with continued battle-focused training, these skills will not be forgotten.

First Lieutenant Swilley, who led 1st Platoon, Alpha Company, 16th Engineer Battalion, during this operation, is the training officer for the battalion. He holds a bachelor's in civil engineering from Louisiana State University and is a graduate of the Engineer Officer Basic Course.

Fording the Imjin River



By Major Keith A. Landry and Captain Aaron Dorf

During the 2d Infantry Division's preparation for the U.S. Forces Korea's maneuver exercise Foal Eagle '99, the 44th Engineer Battalion (Combat) and the 82d Engineer Company (Combat Support Equipment) received the mission to emplace a tactical ford across the Imjin River. The ford site had to pass an armored task force containing M1 Abrams tanks and M2 Bradley infantry fighting vehicles through an 85-meter-wide water obstacle and support subsequent crossings by smaller groups of mechanized vehicles without significant degradation. For the engineer units involved, this task (from their mission-essential task list) provided an excellent opportunity for the chain of command to exercise engineer reconnaissance skills, integrate earthmoving NCO expertise with combat-engineer judgment, and safely emplace a viable ford on a fast-moving river.

Reconnaissance

As part of the troop-leading procedures, the battalion S3, the company commander, and the commander's key leaders conducted a thorough reconnaissance of the proposed ford site. As shown in the site sketch in Figure 1, the Imjin River at this location runs predominately east-west. At the desired crossing site, a rough access ramp led down to the south bank from the existing unimproved road. The exit ramp on the egress bank was nonexistent. There was a one-lane vehicle bridge (concrete deck and steel girders on concrete piers) just 15 meters west of the proposed ford site, but due to severe weathering of the deck and scouring at the base of the piers, the bridge was rated military load class (MLC) 05 and limited to wheeled traffic.

Using both hasty and deliberate reconnaissance techniques described in FM 5-34, *Engineer Field Data*, a team of combat engineers and engineer-equipment operators obtained critical information about the proposed ford site. The river reconnaissance was conducted in two parts: First, the engineers determined the key characteristics of the river, to include the water's depth and speed, river-bottom substrate, and composition of the egress and exit banks. The river-bottom composition was determined by wading into pools of still or slow-moving water at different locations, probing, and gathering soil samples. The hasty analysis revealed a 50/50 mix of cobbles and unsorted stones—mostly rounded float from the surrounding hills—and poorly graded sand without any significant deposits of silt or clay. Using available on-site litter (Styrofoam® and plastic soda bottles), the reconnaissance team calculated the river velocity at the planned crossing site and various locations upstream. The velocity of the water ranged from 0.5 to 3.0 meters per second across the river's width, with the highest flow in a deep, scoured channel adjacent to the exit bank.

Secondly, the reconnaissance team identified the high-velocity flow pattern across the river channel before placing heavy equipment in the water to construct the ford. The riverbed contained localized regions of above-average depth and increased velocity that shifted after each significant rainfall. Fortunately, the river water was relatively clear, which allowed the reconnaissance team to conduct a hasty field dye test to find those high-velocity flow regions. A map reconnaissance revealed an existing ford approximately 400 meters east of the proposed site (point C on the sketch in Figure 1), which would allow the D7 dozers to enter the water and cross the width of the river. Three dozers entered the water in column and traversed the river from south to north and back in high gear. The height of the water ranged from 1.1 to 1.3 meters (just enough to completely submerge the tracks on the dozers at times).

As the dozers crossed the gap, their tracks stirred up enough silt (our field dye) from the river bottom to reveal the high-velocity flow patterns. Five clearly visible flow channels,

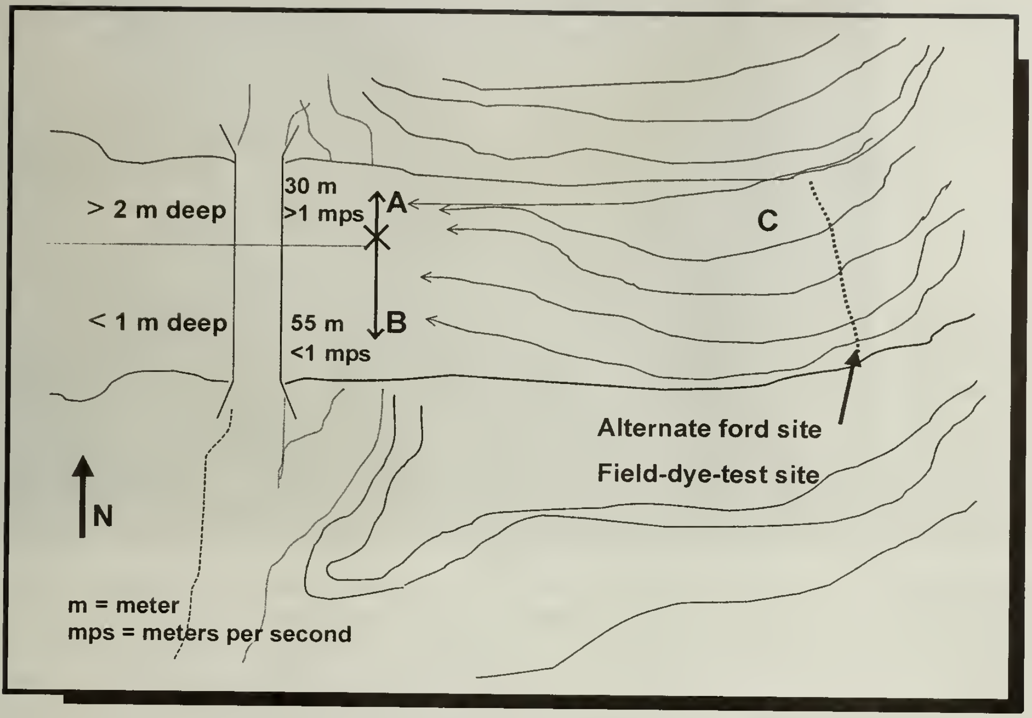


Figure 1. Site Sketch I (Problem)

depicted in Figure 1, were observed from the existing bridge just west of the proposed work site. As a side note, since the dozers were moving in water that exceeded 1.5 meters per second at certain locations, and the actual depth of the water was unknown across the entire river width, specific safety precautions were prescribed. All equipment operators wore Type III life vests when maneuvering in the water, and a safety dozer with recovery chains and life buoys was positioned downstream to assist if needed.

Course of Action

Since the mission was to emplace the ford site close to the existing bridge, it would be necessary to reduce the flow and depth of the high flow channel along the north bank of the river and distribute the water more evenly across the channel to satisfy the safety limits on water depth and velocity defined in FM 90-13, *River-Crossing Operations*:

> *"Combat vehicles can ford shallow rivers that have a limited current velocity and stable beds. Some vehicles have kits to increase fording depth. Fording is possible for current velocities that are less than 1.5 meters per second. Riverbeds at fording sites must be firm and free of large rocks and other obstructions. Vehicle-operator manuals contain specific depth capabilities and required adaptations."*

Based on the results of the field dye test and our hasty calculations, the water depth and velocity were too high to place equipment in the river at the proposed ford site. We had to find a way to drop the volume of water entering the northern part of the river channel, reduce the water depth by 1-2 meters and reduce the water's velocity by more than1 meter per second at the proposed ford site.

In an open-channel flow problem, the quantity or volume of water (Q) flowing through any given cross section is a function of the fluid velocity (V) and the cross-sectional area (A):

$$Q = VA$$

Assuming the quantity or volume of water moving through a cross section of the channel at the ford site was constant, the 82d Engineer Company would have to adjust the water depth across the channel and thus reduce the corresponding velocity. If the engineers could get Q to balance between sections A and B as shown in Figure 1, it would be possible to drop the water depth by 1.8 meters on the north side of the river in the vicinity of the ford site. Short of excavating or dredging a new channel, the only option appeared to be a

Engineer Reconnaissance Data

Facts:

- **Imjin River is 85 m wide**
  Part A: 30 m wide, 3 m deep, > 2 mps
  Part B: 55 m wide, 0.3 m deep, < 1 mps
- **MLC 05 bridge**
- **4 D7 dozers**
- **2 20-ton dump trucks**
- **1 5-yard loader**
- **1 grader**
- **Extensive supply of large river rock available on south bank of river.**
- **Field dye test revealed water flows as shown by arrows on site sketch.**

Two dozers work from south to north, leveling out the river bottom to determine approximate depth and fill requirements across the channel. The water diversion berm is visible in the top left corner of the photo.

temporary water-diversion technique that required the construction of one or more sizable earthen berms in the middle of the river channel.

Getting to Work

Using the four D7 dozers available on-site, a test berm was constructed at a 45-degree angle across one of the five water-flow patterns to determine if this technique would produce a noticeable change in the water distribution across the channel. After 1 hour of earthmoving, the water depth began to drop on the north side and rise on the south side of the channel. Based on the test berm, we calculated that the primary diversion berm would run at approximately the same angle across the river's width for a total of 250 meters. We estimated that the berm, in its final form, would have to be 2.5 meters high and 6 meters wide to withstand small fluctuations in the river's flow for the duration of the exercise.

The finished ford before marking according to the 2d Infantry Division tactical SOP. The water flow across the entire length of the ford has been equalized, thus reducing the depth and speed of the water.

The dozers worked from southeast to northwest, building several smaller berms diagonally across the width of the river. To meet the desired flow speed in the deepest channel, three of the five major flow channels had to be successfully diverted. These smaller earthen berms were constructed of mostly river-bottom material, consisting of large angular gravel, cobbles, and small boulders that were concentrated along several sandbarlike deposits in the river channel. Eventually, these smaller berms were completed and connected to form the primary diversion berm.

Once the primary berm was in place, several hundred cubic meters of small boulders were dumped into the deepest flow channel at the point where the berm and channel intersected on the north side of the river, approximately 275 meters east of the ford site and 25 meters from the northern bank. This significantly slowed the flow of the water in that particular channel, resulting in a reduction of more than 1.3 meters in the water level and a reduced flow velocity of approximately 2.5 meters per second.

The dozers leveled the river bottom from south to north and removed large rocks or small boulders that could hamper tracked-vehicle movement. Working with two 20-ton dump trucks and a 5-yard loader, 400 cubic meters of material of unsorted rocky bank material—generally large gravel and small cobbles—were stockpiled at a borrow site on the south bank of the river. Material was pushed from the shore, then hauled by the 5-yard loader through the water and dumped into the deeper channel on the north side of the ford. As the water level continued to drop, two dozers—

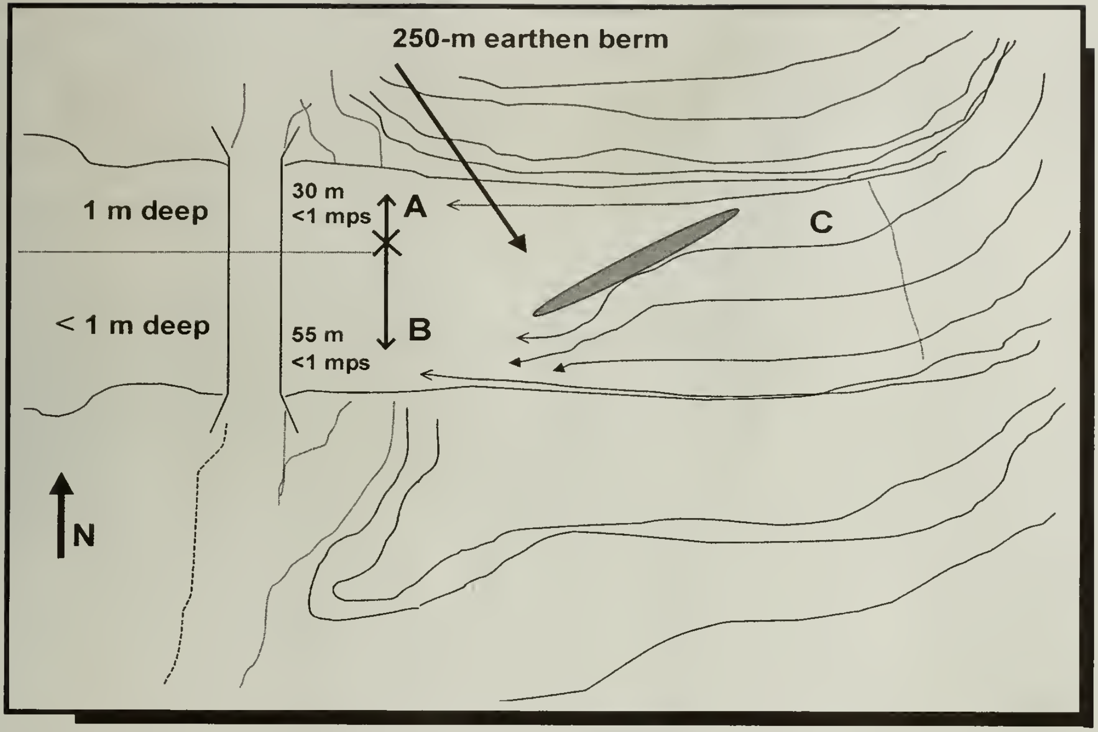


Figure 2. Site Sketch II (Solution)

pushing perpendicular to the ford—piled additional river-bottom material into the ford. This effort began to lift the ford (in essence, creating a weir) so that water would pool upstream and slow below 1.5 meters per second as it moved across the ford.

After two days, the work was completed. Actual work time in the water was 16 hours. The water on the southern half of the ford was 0.5 meters deep. On the northern portion, originally the deepest part of the river channel, the water was less than 1 meter deep. There was decreased flow velocity across the entire width of the river, with a maximum river velocity across the ford of under 1.5 meters per second. The ford site also required significant entrance- and exit-bank preparation in addition to the work in the river itself. This bank work was done in conjunction with the berm and weir preparation. The site sketch in Figure 2 shows the final results.

Lessons Learned

The units learned several important lessons, to include the following:

- Troop-leading procedures work! Whenever possible, conduct a personal recon along with key leaders. In this case, we included our highly skilled engineer-equipment operators and their NCO supervisors. These soldiers knew the equipment capabilities and offered valuable insights on how to safely tackle the problem. Fortunately, the existing bridge served as an excellent vantage point for discussing plans and observing movements on the ford.
- Regardless of the mission, always test the water before placing soldiers or equipment in the water.
- Comply with all local environmental laws and coordinate with all affected landowners or residents.
- Ensure that after conducting a comprehensive risk assessment, all unnecessary risks are eliminated and all required operations are properly resourced, planned, rehearsed, supervised, and executed.

This river-fording mission offered the soldiers and leaders of the 82d Engineer Company and the 44th Engineer Battalion an excellent training opportunity structured around a mission that they could be called on to execute during a hostile situation.

Major Landry is completing a doctorate in civil engineering at Rensselaer Polytechnic Institute in Troy, New York. He was previously the operations officer for the 44th Engineer Battalion, 2d Infantry Division, in the Republic of Korea and commander of C/12th Engineer Battalion, 1st Armored Division in Germany and taught in the Civil and Mechanical Engineering Department at West Point. MAJ Landry is a graduate of the United States Military Academy and the Command and General Staff College; Air Assault, Airborne, and Ranger qualified; and a professional engineer in the state of Virginia.

Captain Dorf is assigned with the Corps of Engineers in Bahrain. He previously served as the Assistant Brigade Engineer, 2d Brigade, 2d Infantry Division, Republic of Korea; and commander, 82d Engineer Company (Combat Support Equipment). CPT Dorf is a graduate of the University of Maine, Orono.

PERSCOM Notes

By Lieutenant Colonel John R. Luce

I want to reflect on my short year as chief of the Enlisted Engineer Branch and provide some perspectives on what I have learned and observed. It has been one of the most rewarding jobs of my 21 years of service in the Army, and I want to thank everyone who has assisted me in this effort.

Military Occupational Specialty (MOS) Health

The health of the enlisted force in the Engineer Regiment is the best it has been in more than a decade. Sixteen of our 21 MOSs are at or over 100 percent strength, and the projections for the future are very good. This is a great improvement in many of our MOSs, especially the 12 series—combat engineer and bridge crew member (mostly attributable to my predecessors). The good news is that we have recovered from the mid-80 to low-90 percent range to well over 100 percent in each of these skills. Because of this, we have had to place these MOSs in the Fast Track and the Excellence in Retention Program (ERP). Through Fast Track, we sent out memorandums to numerous soldiers in the 12 series inviting them to voluntarily reclassify into shortage MOSs in the Engineer Regiment or the Army in general. Currently, the ERP program restricts reenlistment for retraining only. This is why many of you found your reenlistment options reduced as of May. Once we meet our goal of 122 soldiers in 12B and 39 soldiers in 12C, we will reinstate normal reenlistment options. These programs will end when we reach our goals—by each MOS through volunteers—or in September, when we will select enough soldiers for reclassification to meet our goals.

Based on the above information, the strength of engineer MOSs in the units is close to or over 100 percent in the aggregate. Certain ranks are not up to strength. Generally, sergeants and staff sergeants are short in units across the Army because of the increased requirements for drill sergeants and recruiters.

There are some MOSs which continue to run short—00B divers, 52E prime-power-production specialists, and airborne soldiers in 62E and 62J engineer-equipment-operator specialties. Any soldier wishing to transition into one of these skills is encouraged to contact his retention noncommissioned officer (NCO) or Engineer Branch for more details—we need you!

Communication/Career Opportunities

Do you know who your assignment manager is or your professional development NCO (PDNCO)? You should! These people will work your next assignment and decide where you will go. If you want some input into this, you need to know who they are and open up lines of communication. Many of you do and find that although you do not always get your first choice (or even your second), you usually can find an acceptable location. Remember, filling out and submitting a Department of the Army Form 4187, *Personnel Action*, does work! We may not be able to grant all submitted requests, BUT if you don't send one, we won't know your request. If you have more than a year's time on station in the continental United States or are within a year of being eligible to return from overseas, you need to submit a form NOW! Keep on top of this action: call to make sure it arrived, and begin your dialogue with your assignment manager. You need to make the effort to find what is open and let your wishes be known. If you abdicate your vote in this process and do nothing, don't complain.

Your PDNCO is the second key player in this process. We choose three NCOs, one in each Career Management Field (12, 51, and 81), because of their excellent performance and experience. We charge them with the responsibility to review the assignment made by the assignment manager to ensure that it is beneficial for your professional development. These NCOs understand the key elements, positions, and career-enhancing (and terminating) assignments in their field and make sure that you are not given an assignment where you will not be able to progress. They try to avoid assigning you to back-to-back TDA assignments, even though requested, because such assignments are detrimental to career progression. Remember these NCOs are looking out for your best interests and the needs of the Army. If they have failed to meet your expectations or requests, feel free to contact either the branch SGM or this office directly. We are willing to review, with an open mind and a fresh look, any assignment made. If you have questions or concerns about the correct path for promotion and professional development, one of the best sources is the guidance for promotion boards and the review and analysis of the board after it has met. You can find this on the Engineer School's Web site under the Engineer Personnel Proponency Office.

Noncommissioned Officer Evaluation Reports (NCOERs)

Throughout my time in the Army, I constantly have been educated on the importance of our NCOER system—counseling sessions and writing NCOERs well so they "communicate effectively" to both the rated NCO and his professional evaluation board. I heard it so many times that I thought it overkill. However, once in this position, I reviewed a large number of these documents and clearly saw that the leaders in our

Regiment had not learned these lessons. In many cases, unfortunately, the one damaged by this lack of knowledge is the rated NCO! The biggest problem is lack of consistency between the rater and the senior rater—leaving the board the job of sorting out who was correct. If the senior rater disagrees with the rater, the senior rater can annotate his portion of the NCOER to clarify the discrepancy. If he does not and an inconsistency exists between his comments and the blocks that he marks, the reviewer should nonconcur and submit a memorandum of explanation along with the NCOER. This keeps the board from having to interpret and guess the intent of the rating chain. The following are examples of NCOER problems:

- One or two "Excellence" ratings, "Fully Capable" overall rating, and a "2/1" by the senior rater with a "Promote Now" bullet: In this situation, I would expect that the NCO would be among the best and not "Fully Capable."
- One or two "Excellence" ratings, "Among the Best," overall rating, and a "3/3" by the senior rater with a "Promote Ahead of Peers" bullet. In this situation, the senior rater's block ratings either are too low or the rest of the evaluation is too high.
- One to two percent of the NCOERs I have reviewed DID NOT have a comment on promotion potential. It is critical to let the board know what you think.

These examples clearly show an inconsistency, and if the rater and senior rater cannot agree on how to present a consistent picture to the board, the reviewer NEEDS to take the correct steps to give the board the correct impression. An unclear representation to the board puts good NCOs at risk when eligible for promotion and can fail to clearly indicate those NCOs who are not as deserving. A very good source for NCOER information (both the administrative process and content) is PERSCOM Online at The Adjutant General Directorate Web site for NCOER Newsletters.

My Replacement

I have been honored and privileged to serve in this position for the past year. Unfortunately, it is ending too soon. Lieutenant Colonel Pete Taylor will replace me in August. He is a superb officer who will serve the Regiment well in this important capacity. I encourage you to provide him the same support and advice that you did for me—it was all very helpful. Thanks to all.

Lieutenant Colonel Luce is the Branch Chief for Engineer Enlisted Assignments.

Activation of the Facility Engineer Group

By Master Sergeant David C. Cooper

The Secretary of the Army announced the activation of the U.S. Army Facility Engineer Group effective 16 October 2000. The purpose of the 400-soldier Army Reserve unit is to provide specialized engineering support to military commands throughout the United States and overseas.

The unit provides base-operating-system operational planning and technical engineer services for the U.S. Army Forces Command (FORSCOM), the U.S Army Reserve Command, the U.S. Army Training and Doctrine Command, the U.S. Army Materiel Command, power-projection platforms, power-support platforms, and FORSCOM-designated key installations. It offers full-spectrum, senior-level professional-engineer assets for real property maintenance, environmental protection and compliance, and minor construction management and repair to civil infrastructure.

The unit can deploy over 100 engineers, architects, and computer specialists—including numerous professional engineers representing disciplines such as civil, electrical, environmental, and mechanical engineering. It is the only unit of its kind in the U.S. Army system.

"The Facility Engineer Group's unique blend of experts provides the Army with an extremely cost-effective engineering resource," said Colonel Steven R. Abt, the new unit's first commander. "Where else can a commander pay $200/day for an $800/day architect?"

The unit helps the directorates of public works and the Army Reserve commands in inspecting and evaluating the nation's nearly 1,300 Army Reserve centers. Assisted by its regional headquarters in Wisconsin, Texas, Georgia, and Maryland, the unit provides complete coverage of all of the Army's regional support commands in the United States. In addition to the headquarters elements, the Facility Engineer Group fields thirty 7-member facility engineer teams and six 15-member facility engineer detachments.

Before being formally activated, the provisional Facility Engineer Group provided engineering support to peacekeeping efforts in such places as Bosnia and Kosovo and has supported humanitarian operations in Central America. Individual soldiers have deployed during Operations Desert Shield/Storm (Persian Gulf), Uphold Democracy (Haiti), Restore Hope (Somalia), and Joint Endeavor/Guard (Bosnia).

Headquartered with the 416th Engineer Command, the unit's address is: Commander, Facility Engineer Group, Parkhurst USAR Center, 10 South 100 South Frontage Road, Darien, Illinois 60561-1780. The telephone number is (800) 315-6327, the e-mail is *Al.Smith@usarc-emh2.army.mil*, and the Web site is *www.usarc.army.mil/416ENCOM/FEG.*

Master Sergeant Cooper can be contacted at (415) 744-2179 or e-mail *cooper.david@epa.gov.*

Past In Review

Army Engineers in the West

By Dr. James W. Dunn

In the first half of the nineteenth century, Army topographical engineers followed explorers and trappers West to survey and map the territory of an expanding nation. The U.S. expansion into lands claimed by Mexico and the Indians eventually led to wars with both parties. By midcentury, the engineers were surveying and mapping the new territory acquired from the war with Mexico. They surveyed the new border with Mexico, mapped routes through former Mexican lands to the Pacific Coast, and surveyed possible routes for a proposed transcontinental railroad. The Indians did not see these pre-Civil War surveys as an infringement on their land rights. There were no settlers with the surveying parties, and contact with the Indians was rare and usually friendly. When the Indians did resist settlers moving to Oregon or miners to the California gold fields, topographical engineers accompanied Army expeditions to protect the wagon trains and keep open the trails through the West. In the post-Civil War years, as the number of wagon trains westward increased, Indian resistance stiffened into periods of total war. For the engineers, it meant that surveying and mapping duties were at times affected by their duties as combat engineers.

Engineers gained experience in balancing these dual missions during the Mexican War. In 1845, in anticipation of hostilities with Mexico, the War Department ordered Colonel Stephen Watts Kearny to lead an expedition from Fort Leavenworth, Kansas, into Sioux lands in the Platte River Valley to ensure the safety of the Oregon Trail. After a successful conference with the Sioux at Fort Laramie, Wyoming, Kearny turned south and returned to Fort Leavenworth through Mexican territory. Lieutenant William Franklin, a topographical engineer on Kearny's staff, mapped parts of Nebraska, Colorado, and Wyoming, as well as Mexican lands.

During the Mexican War, Colonel Kearny used the Fort Leavenworth-based Army of the West to take New Mexico and then assist the Americans in California who had revolted against Mexican rule. Kearny had an engineer detachment of two lieutenants and two civilian assistants with his Army. Commanded by Lieutenant William Emory, the detachment produced good maps of the southwest, to include the Rio Grande Valley.

After the war, the engineers surveyed and mapped the land acquired from Mexico and a new border between the two countries. In Texas, Lieutenant Colonel Joseph Johnston had four Topographical Corps lieutenants and a Corps of Engineers lieutenant survey fort sites and connecting roads. An 1849 Army expedition into Navaho lands in New Mexico included a topographical engineer lieutenant and two civilian assistants to survey a route to California. In 1854, Captain John N. Macomb of the Topographical Corps began route surveys in New Mexico that ultimately formed the basis for that state's highway and railroad system.

The railroad system in the United States reached the Mississippi River by 1853, and Congress began to consider the possibility of a transcontinental line. With no agreement possible because of partisan politics, Congress told Jefferson Davis, then Secretary of War, to have topographical engineers survey four routes across the United States and recommend the most practical and economically feasible one for a railroad from the Mississippi River to the Pacific Coast. The routes considered were—

- North through St. Paul, Minnesota, to the Puget Sound.
- North central from St. Louis, Missouri, through the Great Salt Lake.
- South central through Albuquerque, New Mexico, to California.
- South along the border to California.

The surveys began in the spring of 1853. The north-central party had trouble in October when Paiute Indians killed Captain John W. Gunnison, a topographical engineer. Artillery Lieutenant Edward G. Beckwith, an 1842 West Point graduate and commander of the escort party, completed the survey along the route which eventually was used to build the Union Pacific and Central Pacific Railroads.

Topographical Engineer Lieutenant Gouvernour K. Warren's work on the railroad surveys aided his effort to map the Trans-Mississippi West territory that included the modern states of Nebraska and North and South Dakota and parts of Wyoming and Montana. In 1855, after the railroad surveys, Warren accompanied Colonel William S. Harney's successful expedition against the Sioux along the Platte River to keep them from raiding the Oregon Trail. In 1856, Warren was back surveying the upper Missouri and Yellowstone Rivers where he had no problem with the Sioux. However, in 1857, when he attempted to survey the Black Hills, the Sioux stopped him. He reported that the Sioux would resist any attempted movement into the Black Hills.

During the Civil War, no surveying expeditions of note occurred in the West, but there were expeditions against the Indians that had repercussions after the war. In a series of campaigns from 1862 to 1864, Minnesota and Iowa militia units pushed the Sioux from Minnesota to the Dakota Territory. In November 1864, a Colorado volunteer unit attacked and destroyed a Cheyenne village at Sand Creek because the Cheyenne resisted the movement of miners and settlers into their lands. In retaliation, the Sioux and the Cheyenne attacked wagon trains along the Oregon-California Trail and the Bozeman Trail that branched off near Fort Laramie and led to the Montana gold fields.

After the Civil War, the Army built Fort Reno to protect the Bozeman Trail. But in the summer of 1866, Red Cloud, a Sioux chief, left a conference at Fort Laramie when he learned that the Army planned to build a chain of forts along the trail. In the ensuing 2-year Red Cloud War, the Sioux successfully resisted movement along the Bozeman Trail. They ambushed and annihilated a cavalry detachment in December 1866, and by 1867, they had closed the trail to all but heavily escorted wagon trains. In the 1868 Fort Laramie Treaty, the U.S. government agreed to abandon the forts and close the trail. The Sioux agreed to a great reservation in South Dakota and use of open land north of the Platte River from the Missouri River west to the Big Horn Mountains.

During the years immediately after the Civil War, the Corps of Engineers, which now included the topographical engineers, placed officers on the staffs of the division and department commanders in the West. Their mission was to prepare maps needed for field operations and to collect topographical information for the Engineer Department in Washington. In the summer of 1867, Lieutenant Rueben W. Pietriken, Chief Engineer, Department of the Platte, surveyed routes from Fort Russell westward to Fort Laramie and onto the Bozeman Trail forts. (Fort Russell was a depot fort used to support the forces involved in the Red Cloud War.)

The first major survey in the post-Civil War period began in 1867 when an expedition sponsored by the Corps of Engineers and led by civilian engineer Clarence King started to survey a 100-mile-wide strip along the 40th parallel line of the Union Pacific-Central Pacific Railroads from the California-Nevada border to eastern Wyoming. The survey, completed in 1872 without significant Indian interference, included a geological analysis report and topographical maps.

The Indians did not oppose King's survey because of a series of cavalry expeditions against the Cheyenne in the late 1860s. In the Medicine Lodge Treaty of 1867, the Comanche and Cheyenne agreed to move onto reservations in the Oklahoma Territory, but they raided into Kansas and Texas in 1868 when government subsistence did not meet their expectations. Major General Philip Sheridan, Commander, Department of Missouri, conducted a winter campaign designed to attack the villages and force the Indians to return to the reservation. Lieutenant Colonel George A. Custer's 7th Cavalry attack at the Washita River in November 1868 and the following winter pursuit did just that. By the fall of 1869, the area between the Platte and Arkansas Rivers was considered clear of hostile Indians. In that area in the early 1870s, Lieutenant Ernest Ruffner, Chief Engineer, Department of Missouri, accompanied the 5th and the 6th Cavalry reconnaissance to survey and map the terrain. As relative calm continued, Ruffner successfully requested a detachment from the Battalion of Engineers so he could expand his surveying and mapping operations.

Lieutenant Colonel George A. Custer

In another major field survey in 1871, Lieutenant George M. Wheeler, Chief Engineer, Department of California, began the United States Geographical Surveys west of the one-hundredth meridian. The tasks included surveying and mapping the area, locating potential military sites and connecting roads, documenting the climate, and reporting on the geology and vegetation of the area. Brigadier General Andrew Humphreys, Chief of Engineers, wanted to support Lieutenant Colonel George Crook's operations against the Apaches while maintaining the Corps's position in western exploration. Accordingly, he lavished money and personnel, to include 16 engineer lieutenants, on Wheeler's efforts between 1871 and 1879. While Wheeler successfully mapped almost one-fourth of the region west of the one-hundredth meridian, Humphreys' effort failed when Congress appropriated money in 1879 for a new civilian agency—the United States Geological Survey—to study the geographical structure and economic resources of the public domain.

Although Wheeler's efforts were largely uncontested by the Indians, such cannot be said for a series of railroad surveys that began in 1871 in the Yellowstone River Valley. To continue the Northern Pacific Railroad from St. Paul, Minnesota, to

Seattle, Washington, surveying parties, escorted by Army units, entered the Yellowstone River Valley in the fall of 1871 without interference from the Sioux. However, when the surveying parties returned in 1872, Sioux resistance served notice that it opposed a railroad along the Yellowstone. Major John Barlow, Chief Engineer, Division of Missouri, accompanied both expeditions and accumulated enough topographical information to publish a map of the Yellowstone from its mouth on the Missouri to the mouth of the Powder River.

When the surveying parties returned to the Yellowstone in 1873, Custer's 7th Cavalry provided the escort, and Captain William Ludlow, Chief Engineer, Department of Dakota, accompanied the expedition. The Sioux attacked surveying parties on two separate occasions in August, but each time, the cavalry drove off the Sioux. The 7th Cavalry's success at protecting the railroad surveyors did not aid Ludlow as he found the cavalry officers too busy with escort duties to help him; thus, he was not able to collect much topographical information.

While Ludlow experienced mixed results along the Yellowstone, Captain William A. Jones, Chief Engineer, Department of the Platte, had some success in a reconnaissance of the headwaters of the Platte. Seeking to locate a route for a wagon road from the Union Pacific rail line in northwest Wyoming to Fort Ellis in Montana Territory, Jones left Fort Bridger, Wyoming, in June with a 2d Cavalry escort, four civilian topographers, and two civilian scientists. After completing his reconnaissance, Jones recommended a route for the road. The Department Commander and the Chief of Engineers endorsed it; however, Lieutenant General Philip Sheridan, Division Commander, could not fund it.

That lack of money—a result of the financial panic of 1873 which put the country into a recession through the 1870s—had an impact on the Corps of Engineers' effort to expand its mapping of the West. In 1873, the War Department supplied the military departments in the West with instruments to make an itinerary of every reconnaissance to post on a master map in Washington. By the end of 1875, however, little data was on the master map due to a lack of money. Captain William S. Stanton, Chief Engineer, Department of the Platte, reported that a shortage of funds restricted his efforts to conduct local surveys. He did not have enough money to hire civilian assistants and had to rely on the cavalry and infantry units for help. While he had the necessary surveying instruments, he lacked qualified assistants, which prevented him from successfully executing the June 1873 War Department order. Other engineers in the West, except for Wheeler, had similar financial problems.

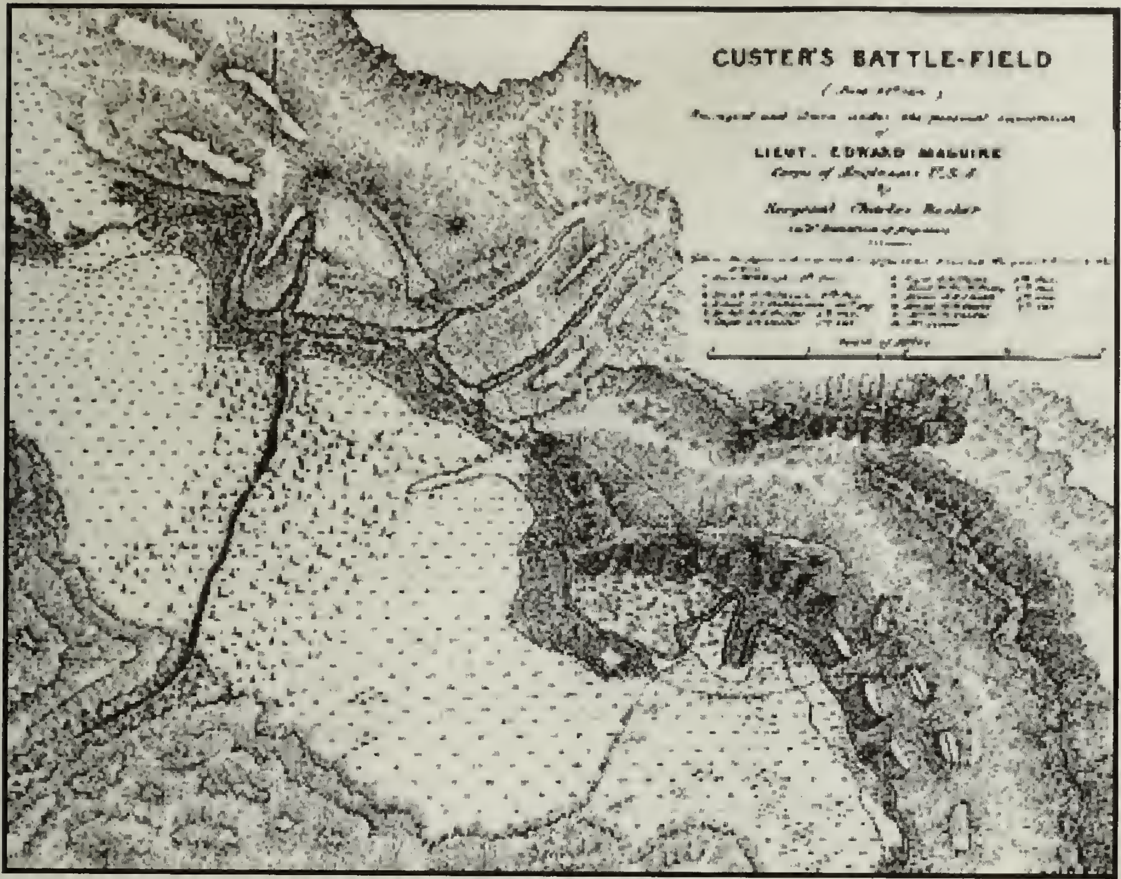
As the engineers struggled with mapping efforts, military operations against the Indians peaked in the last half of the 1870s. In the southern plains, Comanche and Cheyenne raided the Oklahoma Territory and Texas. In the 1874 Red River War, the Army successfully used a winter campaign to drive the Indians back to the reservation. Lieutenant Ruffner was able to produce surveying results during the campaign. While he did not have money to hire civilian assistants, he did send his detachment from the Battalion of Engineers to the 6th Cavalry's expeditions in New Mexico and Colorado. When the 6th Cavalry became heavily involved in the Red River War, Ruffner shifted his efforts to the 5th Infantry's expeditions in Texas. He also built a road from Santa Fe to Taos, New Mexico, with a congressional appropriation of $25,000. He surveyed the route in 1873, and civilians built it in 1874.

While Ruffner successfully used a detachment from the Battalion of Engineers, something similar occurred to the north in the Department of Dakota. In July 1874, Custer led a 7th Cavalry expedition into the Black Hills to locate sites for military posts, survey routes through the hills, and conduct geological surveys. Captain Ludlow again accompanied the expedition with a party that included two volunteer civilian assistants and a detachment from the Battalion of Engineers. Throughout the summer, the expedition operated in the Black Hills without interference from the Sioux, and Ludlow, well satisfied with the results, produced maps of the surveyed routes and topographical and geological maps. He reported that he thought the best use of the hills for the next 50 years was as a home for the Sioux. That did not happen because his report also noted small amounts of gold in the Black Hills. When the news of gold reached the East, which was in the middle of a recession caused by the financial panic of 1873, prospectors raced for the hills.

In 1875, while the Grant administration tried unsuccessfully to buy the Black Hills from the Sioux, Captain Ludlow led an expedition into western Montana to survey routes and examine Yellowstone Park. His party included volunteer civilian assistants and a detachment from the Battalion of Engineers. He noted the large number of hunters and souvenir gatherers in the park and recommended that it be put under the War Department for protection.

Meanwhile, the Grant administration, even though it failed to convince the Sioux to sell, decided to allow prospectors into the Black Hills. The Sioux had until February 1876 to vacate the area and go to the reservation. After that date, any Sioux not on the reservation would be considered hostile and an Army problem. Accordingly, General Sheridan planned a winter campaign similar to the one that proved so successful in the southern plains. However, the winters in the Dakotas and Montana were much more severe than in Oklahoma and Texas, so Sheridan delayed his campaign until the spring. His plan had three converging columns from the east, west, and south, trapping the Sioux south of the Yellowstone River near the Bighorn Mountains.

Colonel John Gibbon's Montana column left Fort Ellis on 1 April with six companies of his 7th Infantry, a battalion of the 2d Cavalry, and two Gatling guns. His acting engineer officer, Lieutenant Edward McClernand, 2d Cavalry, had a detachment from the Battalion of Engineers. As the column moved east along the Yellowstone, in late April, McClernand joined a cavalry scout south through the Bighorn and Little Bighorn Valleys. They made no contact with the Sioux, but later in May, Gibbon



did see signs of a village on the Tongue River. He was unable to force an encounter and, in late May, went into camp on the Yellowstone near the mouth of the Rosebud to await the arrival of the Dakota column.

Brigadier General Alfred Terry's Dakota column left Fort Lincoln on 17 May with Custer's 7th Cavalry, an infantry battalion, and two Gatling guns. His engineer officer, Lieutenant Edward Maguire, Department of Dakota, had a detachment from the Battalion of Engineers; several wagons of engineer equipment, to include a portable trestle bridge; and an odometer cart to measure mileage. As the column moved west across central North Dakota, it made only about 10 miles a day, as Maguire, with the help of a 7th Cavalry company of pioneers, used the bridging equipment to cross the numerous streams along the trail. The column reached the Powder River on 7 June without seeing any Sioux, so Terry sent Major Marcus Reno's 7th Cavalry battalion scouting to the south. Maguire assigned Lieutenant James Sturgis, acting engineer officer, to the scouting force.

Brigadier General George Crook's Wyoming column, the last to take the field, left Fort Fetterman on 29 May with two infantry and two cavalry battalions. His engineer officer, Captain William S. Stanton, Department of the Platte, did not have an engineer detachment and had to rely on the infantry and cavalry units to supply him with assistants. Crook reached the headwaters of the Rosebud on 14 June where he learned of the possibility of a large Indian village to the north. He moved toward the village and encountered a large force of Sioux and Cheyenne in the early morning hours of 17 June. He pushed the Indians toward the Little Bighorn River but was unable to pursue due to his losses and the difficulty of the terrain. When Crook withdrew to refit and await reinforcements, Stanton returned to Fort Fetterman. He felt that the expedition against the Indians was unproductive for engineering work and that he could accomplish more away from an active campaign. He spent the rest of the summer and fall surveying the military posts and connecting routes in the Platte River area.

While Crook was fighting the Battle of the Rosebud, Reno's battalion was about 40 miles to the north following the trail of a large Indian village. Reno heard nothing about Crook's fight, so he told Terry about the signs of a large Indian village to the south. In a meeting with Custer and Gibbon on 21 June, Terry outlined a plan to take advantage of Reno's report. He ordered Custer to move south along the Rosebud while Gibbon moved southwest to the mouth of the Little Bighorn. Custer was to maneuver his regiment to push the Sioux toward Gibbon. Lieutenant George D. Wallace was the acting engineer officer for Custer's force; Maguire and the engineer detachment went with Terry's staff in Gibbon's column.

The 7th Cavalry moved south in the Rosebud Valley on 22 June as Gibbon started west along the Yellowstone. When Custer sighted a large village in the Little Bighorn Valley on 25 June, he planned to wait until the next morning to attack. However, he moved forward immediately when he saw Indian scouts nearby. He divided his force into three battalions and

"...as the number of rail lines increased, the Army reduced the number of small forts in the West. Troops now moved by rail from strategically located forts to trouble spots."

sent Captain Frederick W. Benteen's battalion to the left while he followed Reno's battalion toward the village. As Reno attacked across the Little Bighorn, Custer moved right to attack the village. The Sioux stopped Reno and forced him back across the river to a defensive position on the bluffs. They then turned their attention to Custer and annihilated his force before the end of the day. Benteen joined Reno and held out until the Indians began to withdraw on 26 June as Gibbon's column approached.

Terry kept the combined columns in the Little Bighorn area until 28 June to tend to Reno's wounded and bury Custer's dead. Maguire surveyed and mapped the battlefield and burial site during that time. Terry returned to the Yellowstone River Valley where he refitted and received reinforcements through July. He met Crook's column in the Rosebud Valley in early August, and the combined force pursued the Indians through the rest of the summer. The large Indian village broke up as it moved east, and the combined force made no significant contact. In early September, Terry's Dakota column returned to Fort Lincoln and Gibbon's Montana column headed for Fort Ellis. Crook took his column south toward the Black Hills where he attacked and destroyed a small Indian village on 8 September at Slim Buttes. Many of the Indian survivors returned to the reservation in the winter.

Sitting Bull

As the cavalry columns returned to their forts for the winter, Sheridan ordered Colonel Nelson Miles to organize several posts along the Yellowstone and use the 5th and 22d Infantry Regiments to harass and force the Indians onto the reservation. His acting engineer officer was Lieutenant Oscar F. Long, 5th Infantry Regiment. In December, Miles destroyed a Sioux village near Fort Peck, but Sitting Bull and many of his followers fled into Canada. In January 1877, Crazy Horse, leading a band of about 800 Sioux and Cheyenne, attacked Miles' position on the Tongue River. Miles repulsed the attack, pursued the Indians, and destroyed their village. By the spring, Crazy Horse and most of his followers were on the reservation. Finally, in early May, Miles used elements of the 5th and 22d Infantry and the 2d Cavalry to destroy a Sioux village on the Rosebud and force the Indians onto the reservation. Within one year of Custer's defeat, the Sioux and Cheyenne, except for Sitting Bull and his followers in Canada, were on the reservation.

The engineers experienced mixed results during the 1876-77 campaign. Major George Gillespie, Sheridan's Chief Engineer, Division of Missouri, wanted more Battalion of Engineer detachments in the West with at least one for each department. He thought the topographical information collected during active campaigns lacked quality, as the engineers had to go where the action dictated rather than where their surveying interests indicated. Maguire noted the difficulty of collecting topographical data while accompanying an operational expedition due to the inability to move far from the main force. He recommended a larger bridge train for a force the size of the Dakota column, which had more than one hundred wagons. He reported on the types of improvised bridges used, such as sod-covered wagon tongues, chain-and-rope suspension bridges, and wagon and water-keg floating bridges. Where trees were available, he recommended building trestle bridges.

Maguire's map of the Little Bighorn battlefield played an important role in events related to that fight. In July 1877, Lieutenant Colonel Michael Sheridan, brother and aide to General Sheridan, led a party to the battlefield to remove officers' bodies for reburial in the East and to rebury and mark the graves of the rest. He used Maguire's map to locate the original burial sites. In the January 1879 Court of Inquiry—held at the Chicago Headquarters, Division of Missouri—that examined Major Reno's conduct at the Little Bighorn, Maguire used his map to testify on the battle.

For the remainder of the 1870s, the engineers in the West kept as active as congressional appropriations allowed. In the summer of 1877, Ruffner used a 9th Cavalry expedition into New Mexico and Colorado to locate sites for military posts and survey connecting routes. Maguire named acting engineer lieutenants from the 5th Cavalry and the 7th Cavalry for the fall 1877 campaign against Chief Joseph and the Nez Perce in western Montana. He also sent a detachment from the Battalion of Engineers to survey the site for Fort Keogh at the mouth of the Tongue River on the Yellowstone. He used Quartermaster Department money to examine the Yellowstone's use as a supply route for the military posts in the Montana Territory. In 1878, while Ruffner was building wagon roads connecting the military posts in Colorado, Maguire continued surveying Fort Keogh and the Yellowstone River. In 1879, he added Fort Custer (at the mouth of the Little Bighorn River) and the Little Bighorn battlefield as survey projects for his engineer detachment. He continued to work on the Yellowstone River, using money from the River and Harbor Act of 1878 to hire workers to open channels through three rapids. As he traveled throughout Montana by river steamer, stagecoach, and Army ambulance, Maguire reported to the Chief of Engineers on the quality of the schools in Bozeman and the number of settlers, type and quantity of livestock, and amount of land under cultivation in the Yellowstone Valley.

In the 1880s, a chapter closed on the history of Army engineers in the West. The United States Geological Survey, a civilian agency, now studied the geographical structure and economic resources of the public domain. In 1881, as the government erected a stone monument in the Little Bighorn cemetery, Sitting Bull and his followers surrendered at Fort Buford in the Montana Territory. The Northern Pacific Railroad reached Billings, Montana, in 1882, and the engineers reported a decrease in traffic on the Yellowstone River. By the end of the 1880s, three railroads crossed the continent, and as the number of rail lines increased, the Army reduced the number of small forts in the West. Troops now moved by rail from strategically located forts to trouble spots. As campaign and topographical duties decreased, the engineers turned their attention to border and coastal defense and river and harbor activity. In the twentieth century, these responsibilities, termed Military Programs and Civil Works, became increasingly important as the nation fought through a deep depression and several major wars.

Dr. Dunn is a historian in the Office of History, U.S. Army Corps of Engineers, Alexandra, Virginia.

Suggested Reading

Frank N. Schubert, *Vanguard of Expansion: Army Engineers in the Trans-Mississippi West, 1819-1879.* Washington, D.C. Historical Division, Office of Administrative Services, Office of the Chief of Engineers.

Robert M. Utley, *The Lance and the Shield; The Life and Times of Sitting Bull.* New York, Henry Holt, 1993.

(BCTP Terrain Analysis, continued from page 29)

The WCOPFOR is made up of experienced players who are extremely proficient at taking advantage of CBS terrain. Many of them are retired Army officers who clearly understand our doctrine and use CBS terrain during their military decision-making process. Because of their vast knowledge and experience, they have both a tactical and planning advantage over units being exercised and evaluated.

Payoffs of CBS Terrain

If properly displayed and explained, CBS terrain has many payoffs during the military decision-making process and throughout the course of the Warfighter exercise. Enemy avenues of approach become evident, which allows the intelligence community to focus its human, imagery, electronic, and signals intelligence-collection efforts. The deep-operations coordination cell can easily identify engagement areas, which allows it to concentrate deep fires, close air support, and air-interdiction assets, resulting in immense destruction of enemy units. By knowing the location of every bridge in the exercise area, engineers are better able to tie CBS restrictive terrain to their division-wide obstacle plan. They know exactly which rivers can be forded and what bridging assets are required when bridges are destroyed. Logistic planners are able to select main and alternate supply routes, forward-operating bases, refuel-on-the-move sites, and division support areas. Maneuver brigades can better plan their advance, select defensive positions, and seize the momentum by knowing exactly where they can and cannot maneuver.

Terrain-analysis units have the ability to display CBS terrain data in a variety of formats. The clear overlay is still a most sought-after format since nondigital divisions have map boards hung throughout the tactical-operations center. For engineers, Microdem/TerraBase II can display CBS terrain over maps, imagery, and elevation data. Once the product is displayed, Microdem/TerraBase II can easily export the graphic to a PowerPoint® presentation for use in briefings.

Summary

Terrain analysis is an engineer function, and topographic engineers are masters at producing mission-focused and -tailored terrain graphics in support of Warfighter exercise operations. Planning a BCTP Warfighter exercise must be approached the same way as planning for an actual deployment. The significant difference is that CBS terrain is the only terrain that counts during a BCTP evaluation.

CW2 Mohn commands the 25th Engineer Detachment (Terrain), Schofield Barracks, Hawaii. Previous assignments include terrain-analysis technician, XVIII Airborne Corps, Fort Bragg, North Carolina; senior career management NCO (CMF 81), Engineer Personnel Proponency Office, Fort Leonard Wood, Missouri; and terrain analyst, USAREUR Combat Intelligence Readiness Facility, Augsburg, Germany.

Supporting the Title X Engineer Effort in the Balkans

By Major Garth M. Horne and Mr. Eldon "Scott" Lowdermilk

The U.S. Army Corps of Engineers (USACE) continues to provide continuous and diverse support to engineers and commanders in the Balkan area of responsibility. Currently, USACE has soldiers and civilians deployed in Germany, Hungary, Bosnia-Herzegovina, Kosovo, and the Former Yugoslavian Republic of Macedonia (FYROM) in support of various engineer requirements resulting from U.S. contingency operations.

The majority of the forward-deployed USACE support is provided by teams. The size and makeup of the teams are based on an analysis of the task-force engineer's requirements by the Office of the Deputy Chief of Staff, Engineer (ODCSENGR), United States Army, Europe (USAREUR). The main-body team, called a Base Camp Coordinating Agency (BCCA), coordinates the engineer construction being performed by military and civilian personnel and contractors in the task-force area of operations.

Soldiers classify a tunnel

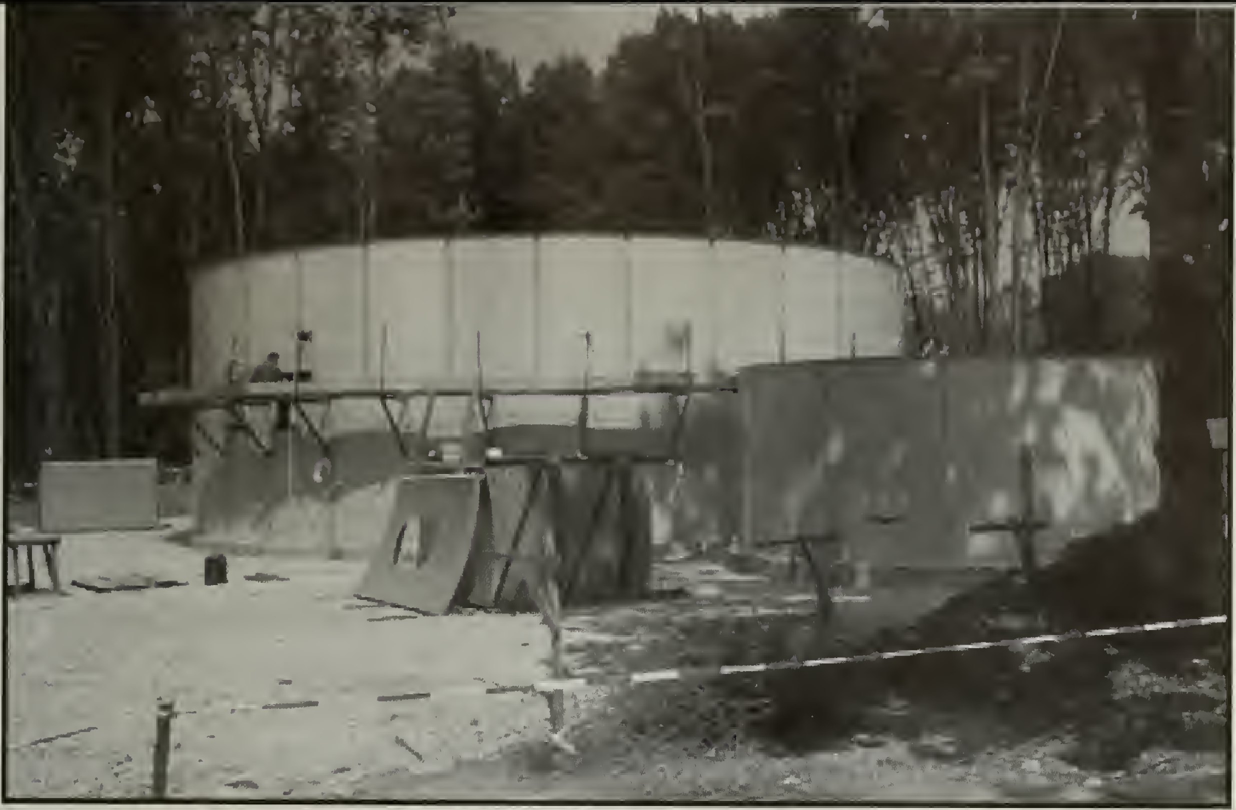
The BCCA employs several technical capabilities. For instance, there are master planners, who design base-camp layout for the best use of facilities and land management. In addition, draftsmen—through the use of computer-aided design (CAD) software such as AutoCAD®—maintain detailed plans and drawings of the camps as well as other facilities being constructed or refurbished.

All but one of the USACE employees work in either the BCCA or on engineer staffs, and the remaining employee is assigned to USAREUR as the Operation Joint Forge cell chief. He serves as the primary liaison between the BCCA and base-camp staff engineers and ODCSENGR. The USACE civilian personnel are facility, mechanical, environmental, structural, and multidisciplined engineers (project mangers), as well as construction representatives, real estate specialists, and AutoCAD operators. Additionally, ODCSENGR uses Reserve USACE officers on 179- and 270-day orders to fill BCCA engineer positions in Bosnia, Kosovo, and USAREUR. The Reserve officer's role is expected to increase as the Balkans mission continues.

Title X

Contingency construction in support of USAREUR's mission in the Balkans is provided under the auspices of 10 U.S. Code 101 (a)(13) often referred to as "Title X." Appropriations for military construction are not used for contingency operations when construction is clearly intended to meet a temporary operational requirement to facilitate combat or contingency operations and the construction is not permanent. Congress provides the actual funding for contingency operations and supporting construction through supplemental appropriations.

The USACE Europe District—headquartered in Wiesbaden, Germany—serves as the "door to the Corps" for the European Command and USAREUR engineers in coordinating deployments to the Balkans and providing technical support as needed. Both military and civilian employees of the USACE provide technical expertise, design capability, project management, and quality-assurance assistance and support to the USAREUR in overseeing the Title X effort. This covers all areas of logistical and facility support to U.S. personnel deployed in the Balkans—construction, environmental, topographic, fire fighting, hazardous material (HAZMAT)/spill response, countermine/demining, base-camp standards, prime power, real estate, bridging, and snow and ice clearing (SNIC).



Wastewater treatment plant at Comanche Base in Bosnia

The ODCSENGR plays a major role in overseeing the Title X effort, which includes the support provided to other services, mainly the Air Force and to a lesser extent the Navy. Operationally, units within the Balkans report and operate under various commands that report to either NATO or subordinate USAREUR commands.

Construction. This is the area where USACE expertise and assistance has been used the most under Title X support. To provide such things as food, laundry, fuel, lodging, and morale and welfare support, either new facilities must be built or existing facilities renovated. All operations in the Balkans are considered contingency operations and thus require temporary construction. ODCSENGR defined temporary construction as that which "must be designed and constructed on an expedient basis, with finishes, materials, and systems selected with energy efficiency, maintenance, and life-cycle costs being secondary considerations with a life expectancy of 5 years or less."

Consistently using temporary construction standards is an ongoing challenge when units rotate in and out. Commanders constantly weigh the importance of trying to improve the soldier's quality of life (QOL) beyond that enjoyed by previous rotations versus creating a legacy from their tour that soldiers will remember and identify with and congressional visits will point to as a poor use of taxpayer dollars. This is often referred to as "QOL creep."

In Kosovo, U.S. Department of Defense engineers (Army and Navy) worked on initial construction requirements such as site preparation and critical facilities.[1] However, civilian contractors now execute most of the construction in Kosovo and Bosnia.

The Corps has several tools to ensure that construction can be performed, the main one being contract construction. One contracting tool is the indefinite delivery, indefinite-quantity (IDIQ) contracts that are maintained with reputable firms that can be turned on with little notice. These contractors are usually prepared to travel anywhere they are needed. However, the most widely used tool is the Logistics Civil Augmentation Program (LOGCAP) contract.[2] This is a cost-plus contract that can be used to provide any service or construct anything that is needed by a military commander. Because the U.S. military has downsized so dramatically, it maintains a reserve capability through contract support. The LOGCAP contractor is awarded a contract to provide services and construction on an as-needed, reimbursable basis.

A LOGCAP-type contract supports operations in Kosovo and Bosnia. In the early days of these operations, the Corps's emergency managers coordinated with several military units to develop a scope of work for anything and everything that the contractor might be asked to perform. Since the contract was relatively unknown to many maneuver commanders, this coordination proved to be invaluable. Today, the Balkans Sustainment Contract (BSC) still carries out the lion's share of Title X construction, providing transportation, dining and bed-down facilities, laundry services, waste management and disposal, and a host of other services to deployed forces.[3] The BCCA provides construction oversight for the BSC and other construction-related contracts in the Balkans.

Environmental. USACE deploys civilian environmental specialists to provide technical oversight on base-camp and forward-operating-base operations to ensure that U.S. personnel comply with environmental regulations, protect human health, and practice responsible environmental stewardship. Located within the BCCA at Task Force Eagle and Task Force Falcon and on the National Support Element engineer staff at Taszar, Hungary, these specialists establish and document environmental baseline surveys at base-camp and forward-operating-base locations, conduct periodic sampling at base camps, and monitor wastewater-treatment operating parameters and performance, pest and vector control, and general environmental-program management and controls. They also assess current practices and activities to identify environmental concerns and develop action plans to address those concerns and to minimize or prevent waste and other forms of pollution.

Topographic. USACE provides limited topographic support to base camps through the BCCA AutoCAD operators and their specialized equipment. In addition, a USACE contractor developed a Bosnia master plan to assist in land management. Most topographic support is coordinated through ODCSENGR's Geospatial Information System (GIS) officer, using the 60th Topographic Detachment, which is attached to ODCSENGR.

Fire Fighting. The BCCA staff helps develop and maintain fire-inspection and -prevention measures. USACE has provided technical expertise on alarm systems and individual and structural fire-fighting equipment.

HAZMAT/Spill Response. The BCCA environmental specialists provide guidance on HAZMAT storage and management, to include spill response, although the BSC is primarily used for spill response. Initially, in Kosovo, Department of Defense fire-fighting teams were deployed to provide general fire-fighting services and HAZMAT/spill response.After initial-entry operations and the establishment of base camps, fire-fighting facilities and equipment were delivered through the BSC. Eventually, the general fire-fighting service, facilities, and equipment were all provided through the BSC. This freed up military firefighters, a low-density capability, for other deployments by March 2000.

Countermine/Demining.[4,5] The BCCA assists in ammunition-surveillance maintenance requirements. This has focused on developing plans to correct new deficiencies noted during each inspection of ammunition-storage and -holding areas where unexploded ordnance is stored as a result of weapons- and ammunition-collection efforts and demining operations.

Base-Camp Standards. ODCSENGR has established a Red Book on Base-Camp Standards to prescribe uniform facility standards within the limits of good fiscal stewardship for the Balkans. The ODCSENGR contracted a company through the USACE Europe District to develop a master plan for Bosnia for the next 3 to 5 years that would provide a prioritized road map on how to get from the existing conditions to the Red Book standard. The independent, coordinated effort of the master plan also provides supporting justification for the remaining construction effort in Bosnia. Construction managers and quality-assurance representatives from the BCCA ensure that proper construction practices and methods are being followed, that there are no safety hazards, and that contractors are meeting their requirements.

Prime Power. In both Bosnia and Kosovo, commercial power was not available when U.S. forces began their peacekeeping missions in support of NATO. The 249th Engineer Battalion (Prime Power), Fort Belvoir, Virginia, provided power generation initially and helped plan and coordinate for continued power generation beyond the initial-entry time frame.[6] Commercial power is now used in Bosnia; however, the 249th still leases some equipment to support Task Force Eagle. In Kosovo, commercial power will not be available for at least 2 more years. Technical experts have assisted ODCSENGR by gathering information to increase efficiencies with the current power-generation system and to develop a power-generation plan for the next few years until commercial power is available.

Real Estate. USACE provides personnel on both a temporary and a permanent-hire basis (1-year tours) to handle real estate issues. Real estate expertise is required to execute leases at every site that U.S. personnel camp at or use. This has been especially challenging in Kosovo, where the landowners may not be known or multiple parties may claim ownership. Real estate specialists in the BCCA ensure that real estate impacts are included in construction-cost estimates so that potential real estate problems can be avoided. When claims are made against the United States for property damage, these specialists assess the damage and compare it to preexisting conditions to help settle claims.

SNIC. A USACE expert develops SNIC plans for the base camps and the main supply routes and lines of communication to and from the base camps and surrounding areas—a critical effort during the winter months. ODCSENGR purchased 5-ton and high-mobility, multipurpose wheeled vehicle (HMMWV)-mounted snowplows and sand spreaders to give each task force the capability to operate when road conditions would otherwise be BLACK. The Cold Regions Research and Engineering Laboratory (CRREL) sent a training team to help install the equipment and train operators. This technical assistance and training is still provided annually before the snow season since units rotate out every 6 months, taking the experience and trained operators with them. Initially, in both Bosnia and Kosovo, the task-force engineers were responsible for SNIC. Although engineers from both Task Force Falcon and Task Force Eagle retain a SNIC capability, once the operational environment stabilized, they contracted out base-camp and task-force route clearance to host-nation contractors through the Defense Contract Management Command. SNIC along NATO routes is contracted out by the Stabilization and Kosovo Forces.

General Engineering and Technical Support

USACE provides additional engineering and technical support to ODCSENGR, divisional engineers, and commanders in the Balkans that is outside the basic Title X categories. For the most part, any support or expertise that USACE possesses has been used. Over the past year, this support has included the following areas:

Camp Bondsteel airstrip before paving

Paving the Camp Bondsteel airstrip

Tele-Engineering.[7] USACE, through the U.S. Army Research and Development Center's Waterways Experiment Station (WES), established Tele-Engineering capability between the Task Force Falcon BCCA and ODCSENGR at the beginning of the Kosovo mission, using a deployable video teleconferencing (VTC) system. This high-speed data link via satellite enabled ODCSENGR to conduct secure VTCs as well as other secure data transfer among ODCSENGR, WES, USACE Europe District, and the Task Force Falcon BCCA to coordinate various operational and construction issues. Personnel in the Balkans were able to consult with subject-matter experts thousands of miles away. This is tremendous value added to any operation since it keeps the number of deploying personnel down and gives access to a larger pool of experts.

The capability—used daily during the first months of the Kosovo mission—is still used at least weekly to continue coordination on construction progress and issues and to achieve efficiencies in construction methods and resource usage on a Balkans-wide basis. Over the past year, Tele-Engineering capabilities have been extended to divisional engineer brigades in Germany, the 130th Engineer Brigade, and the Task Force Eagle BCCA.

Laboratories/Centers of Expertise. In addition to the CRREL support for SNIC, USACE laboratories and centers of expertise have deployed personnel and teams on the following missions:

- **Bridge and Route Reconnaissance**. The USACE structural engineers perform surveys for both vehicular and train routes and assess the load classifications of bridges that may be crossed with heavy equipment on main supply routes.
- **Asphalt Capability Assessments**. Geotechnical experts perform soil stabilization and test batch samples of asphalt and concrete prepared by local batch plants. USACE sent asphalt experts into FYROM and Kosovo to assess bituminous-production capabilities and paving-materials availability.
- **Base-Camp Closure Environmental Assessments**. Numerous base camps and forward-operating bases have been closed in the Balkans. USACE has contracts in place for conducting environmental assessments, as required, which are coordinated through the permanent-party USACE environmental specialists/coordinators in each area. A comparison is made to the baseline survey to develop accurate scopes of work and timetables for returning land that is no longer used. Real estate specialists and supporting teams are also available to coordinate lease impacts.
- **Force Protection**. A force-protection expert ensures that camp design, layout, and function meet mission requirements while affording camp personnel with uniform force-protection measures based on the threat level. The USACE security-engineering and force-protection specialists were also used during camp planning and construction.
- **Well Drilling**. Hydrologists find the best places to drill for water, which has proved invaluable in areas where local water supplies are either not available or not potable. For larger base camps, wells have also resulted in a significant decrease in daily operations costs to the Army through greatly reduced water purchases.

USAREUR Engineer Repository.[8] The ODCSENGR used WES to purchase and install hardware and software, populate the database, and finalize system requirements for an engineer repository. WES also provides training for the system, database administrator, and users. A secure Engineer Information Repository Web site is under development, and a nonsecure site can be accessed at *http://engrep.-hqusareur.army.mil.* These sites contain archived copies of operations, after-action reviews, studies, and reports of various operations conducted in the Balkans and elsewhere within USAREUR's area of responsibility. In addition, both sites include country studies and other useful information.

A Combat Multiplier

There are a lot of new initiatives on the horizon as the Army prepares for a transition to the Objective Force. USACE has provided quality, responsive engineering services to the nation and the Department of Defense for a long time and is getting better with each operation. Military officers and civilian emergency managers in the Balkans face unique missions and often experience an uphill fight in getting support from counterparts in other USACE offices in the United States. By working through the technical and traditional problems with command support and emphasis, we are producing an engineering organization that has truly been a combat multiplier in the Balkans.

Major Horne, a deputy district engineer for the Sacramento Engineer District, served as the ODCSENGR Operation Joint Forge liaison officer for 6 months. He previously commanded Bravo Company, 91st Engineer Battalion, Fort Hood, Texas. MAJ Horne holds a bachelor's in civil engineering from West Point and a master's in environmental engineering from the University of Washington.

Mr. Lowdermilk is the chief of Operations, Plans, and Security for the Europe District in Wiesbaden, Germany. Past assignments include contingency plans officer, Transatlantic Programs Center, 1991-1996; operations officer, Europe District, 1996 - 1998; and contingency plans officer, Europe District, 1998 - 2000. Mr. Lowdermilk has an associate's in survival and rescue operations and a bachelor's in emergency management.

Endnotes:

[1] COL Robert L. McClure, "The Engineer Regiment in Kosovo," *Engineer*, April 2000, pp. 6-10.

[2] COL Donald T. Wynn, "Managing the Logistics-Support Contract in the Balkans," *Engineer*, July 2000, pp. 36-40.

[3] Ibid.

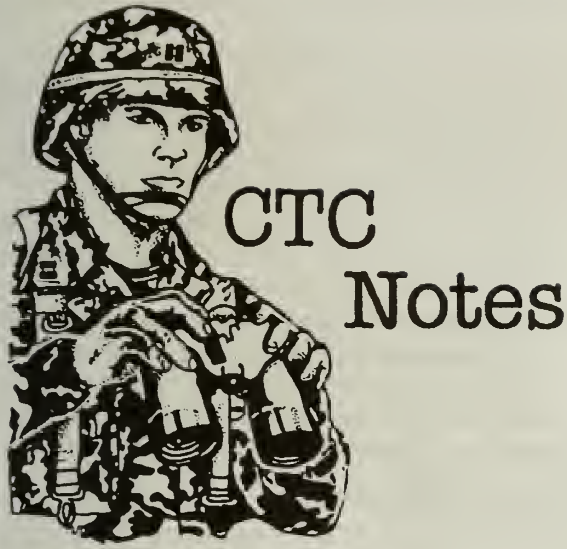
[4] 1LT Eric Midden, "Demining in Bosnia-Herzegovina" *Engineer*, February 2001, pp. 20, 26.

[5] COL Andrzei Zarczynski, "Mine Threats in Mission Areas," *Engineer*, February 2001, pp. 4-7.

[6] CPT Jared Ware and SFC Ed Dawe, "The Next Generation of Power Generation," *Engineer*, July 2000, pp. 7-10.

[7] Dr. Paul F. Mlakar Sr., James C. Ray, and CPT Todd C. Liebig, "Bridge to the Future: Tele-Engineering and the Bubiyan Bridge Assessment," *Engineer*, April 1999, pp. 44-46.

[8] MAJ Barrett W. Larwin, "Enhanced Off-the-Shelf Technologies Help Engineers Prepare for Future Operations," *Engineer*, October 2000, pp. 38-39, 46.



National Training Center

The Engineer Company TOC—A Critical Link in the Company's Success

By Lieutenant Colonel Thomas H. Magness and Captain David G. Ray

The Engineer Company Tactical Operations Center (ETOC) is often overlooked and receives minimal training or resourcing during a unit's preparation for a rotation at the National Training Center (NTC). However, many trends indicate that the effectiveness of an engineer company at the NTC is greatly influenced by the performance of the ETOC. This squad-sized element fills several roles: command post (CP) for the engineer company, mobility/survivability (M/S) Battlefield Operating System (BOS) representative for the supported maneuver task force (TF), and a direct liaison officer between the brigade combat team's direct-support engineer battalion and the maneuver TF.

ETOC Functions

An ETOC must perform the following six functions to effectively provide command and control for engineer elements operating in the TF sector and M/S BOS support to the TF:

Receive Information. An ETOC must receive information from the parent engineer battalion, the supported maneuver TF, and subordinate or attached engineer units operating within its area of operation (AO) to execute the remaining five TOC functions effectively. It is this function that dictates the need for the ETOC to possess the same command, control, communications, computers, and intelligence (C4I) capabilities as the engineer-company commander, supported TF, and parent engineer battalion.

- *Critical supporting tasks:*
  1. Receive messages, reports, orders, and overlays digitally or by frequency modulation (FM) or courier.
  2. Monitor and understand tactical situation.
  3. Maintain a log of significant activities and reports.
  4. Maintain status of critical classes of supply.
- ***Noted trend***–*ETOCs are often unable to maintain effective communication with subordinate and higher-echelon engineer units.* This trend can be reversed by fully leveraging the C4I capabilities available within the engineer unit and supported TF. Digitized units must fully exercise the capabilities of the Force XXI Battle Command Brigade and Below System, and nondigitized units must fully leverage FM systems—including TF- and brigade-level retransmission capabilities, mobile subscriber radiotelephone coverage, and tactical facsimile, if available.

Distribute Information. An ETOC must be capable of rapidly distributing the information it has received to the elements requiring the information. This function must have adequate C4I capabilities and personnel trained to use the equipment.

- *Critical supporting tasks:*
  1. Submit reports to higher engineer and supported TF headquarters.
  2. Serve as a communication relay between units.
  3. Publish orders and instructions.
  4. Process and distribute information to appropriate units or staffs.
- ***Noted trend***–*Units do not effectively track and disseminate obstacle information affecting TF mobility.* This includes friendly obstacles, planned or executed, and enemy obstacles confirmed within the TF, AO, or area of interest. The assistant task-force engineer (ATFE) should ensure that this information is posted on the engineer battle-tracking boards and the TF's current operations map and disseminated to the lowest level possible using obstacle overlays and FM updates. The use of a doctrinally correct obstacle-numbering system within the TF sector will improve the communication of obstacle status to the maneuver elements. It is also important that the ETOC monitors the communication of scatterable-mine warnings within the TF sector and to higher headquarters. The ETOC must be the critical node in collecting, verifying, and forward processing of hard copies of Department of the Army Form 1355, *Minefield Reporting*. Emplacing any land mines by U.S. forces must be thoroughly documented and then forwarded to the higher headquarters.

Analyze Information. The personnel manning an ETOC must continuously analyze the information from subordinate sources and higher echelons as to how it is affecting the M/S support of the current TF's scheme of maneuver. This function requires that the members of the ETOC fully use their training and professional experience as combat engineers.

- ***Critical supporting tasks:***

  1. Identify information related to the commanders' critical information requirements (CCIRs), essential elements of friendly information (EEFIs), priority information requirements (PIRs), and decision points.
  2. Prepare an engineer estimate.
  3. Conduct predictive analysis.
  4. Conduct terrain analysis.

- ***Noted trend–****Personnel in ETOCs are not trained to identify critical information, conduct predictive analysis, or use a decision-support matrix.* All members of the company CP must be familiar with the CCIRs, EEFIs, and PIRs designated for each operation. They must also understand the three components of the engineer battlefield assessment to analyze critical information in a timely manner.

Make Recommendations to the Commander. Filling the role of company operations officer and TF special staff officer, the ATFE and other members of an ETOC must be capable of rapidly and effectively communicating sound recommendations to the TF and engineer-company commanders.

- ***Critical supporting tasks:***

  1. Develop and use decision-support template.
  2. Conduct tactical decision-making process (TDMP).
  3. Create/publish countermobility and survivability timelines.
  4. Recommend priority of employment of engineer assets.

- ***Noted trend–****ETOCs do not rapidly provide alternate courses of action (COAs) when fluctuations in time or assets available cause M/S effort to deviate from original plan.* All personnel in the ETOC must understand the engineer company and supported unit commander's intent. During the TDMP, the TF engineer must develop alternate engineer COAs based on likely changes in time and assets available. These COAs should be tied to specific actions that occur on the battlefield. They must be developed enough to be presented to the TF commander and implemented upon his approval.

Integrate Resources. An ETOC is responsible for coordinating actions internal to the engineer company and the M/S actions of the supported TF. Also, the ETOC must integrate vertically with higher engineer headquarters and horizontally with adjacent engineer units. It is essential that all members of the ETOC understand how to integrate with the remaining six BOSs during planning and execution of combat operations. The ETOC participates in all steps of the TF planning process and all TF-level rehearsals. During the military decision-making process, the ATFE conducts direct coordination with BOS representatives to ensure that all elements operating in the TF sector understand the scheme of engineer operations (SOEO).

- ***Critical supporting tasks:***

  1. Conduct report procedures.
  2. Develop the SOEO.
  3. Conduct obstacle integration.
  4. Plan combined-arms breaching operations.

- ***Noted trend–****ETOCs do not address the essential elements of integration with the other BOSs during the planning, preparation, and execution phases of each operation.* All members of the ETOC must understand the role of the seven BOSs. It is essential that they understand how the M/S BOS supports and/or is supported by the other six. This is accomplished by maximizing opportunities to cross-train all members of the ETOC with members of the TF TOC.

Synchronize Resources. An ETOC must coordinate and synchronize the activities of all M/S assets within the TF AO. This process begins during the TDMP, as the ATFE ensures that the M/S BOS is represented during the war-gaming process and the development of the TF synchronization matrix. All members of the ETOC must understand how planned engineer actions relate to the actions of the other BOSs in the TF. The ATFE conducts the coordination before and during the war-gaming process. Thorough coordination before the COA analysis ensures that the SOEO is feasible and supports the TF commander's intent.

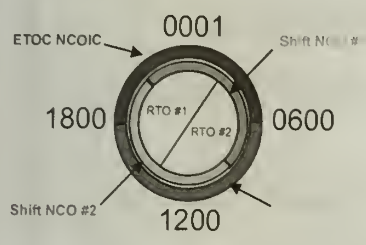
- ***Critical supporting tasks*****:**

  1. Prepare an engineer annex.
  2. Participate in a TF war-gaming session.
  3. Conduct battle tracking of engineer assets.

- ***Noted trend–****ETOCs do not fully leverage the war-gaming process and TF-level rehearsals to adequately synchronize the M/S effort within the supported TF sector.* The ETOC must fully participate in all synchronization activities of the supported TF. During the war-gaming process and development of the synchronization matrix, all actions and effects of M/S assets must be included. During TF-level rehearsals, the presence of M/S factors must be addressed along with the actions of key engineer elements. Full participation in these activities will ensure synchronization with the other BOSs in the TF.

NTC Tactics, Techniques, and Procedures

Battle Rhythm. The ETOC must be effective during all phases of each mission (planning, preparation, and execution) for 14+ days of continuous operations. Each phase requires input from the M/S BOS; therefore, it is critical that trained and combat-effective personnel are on duty and contributing to each phase of the mission. The ETOC leadership must ensure that an effective battle-handover/shift-change plan is in place to ensure no loss of situational awareness (see Figure 1). To ensure that roles are filled and executed effectively, specific duties and responsibilities for each position should be



Note: Use of a shift wheel to set ETOC personnel schedules will ensure maximum situational awareness at all times.

Figure 1. Example ETOC Shift Wheel

documented and placed in a TOC standing operating procedure (TOCSOP). This document will allow new personnel to quickly understand their roles and responsibilities as part of the ETOC. Smooth integration of new personnel will minimize the effects of personnel changes.

Individual Roles. The ATFE must not try to accomplish all missions and handle issues during all phases. He must be heavily involved in planning for future operations with the supported TF. This forces the operations noncommissioned officer (NCO) and remainder of personnel assigned to the ETOC to support the executive officer (XO) and handle current operations. This means the TF current operations section must rely heavily on the ETOC noncommissioned officer in charge and shift NCOs. Most often these individuals have not been battle-staff trained, but they must execute home-station training that educates them to that level. It is essential that the ETOC function without the presence of the engineer-company XO.

Providing Engineer Expertise to the TF XO/S3/Battle Captain. All personnel within the ETOC should be trained to provide timely and accurate engineer advice to the supported TF. Each member of the section should be current on engineer doctrine, engineer munitions, engineer planning factors, and engineer equipment/logistical requirements. Therefore, a functional field manual/technical manual (FM/TM) library should be accessible along with a battle book that is tailored to the needs of the supported TF. The ATFE must be the M/S BOS expert with the capability to analyze any friendly or enemy engineer actions and provide effective recommendations to the TF commander. The following items are essential to provide doctrinally sound M/S advice to a maneuver TF:

- FM 5-34, *Engineer Field Data*, August 1999.
- FM 20-32, *Mine/Countermine Operations*, May 1998.
- FM 90-7, *Combined Arms Obstacle Integration*, September 1994.
- FM 3-34.2, *Combined-Arms Breaching Operations*, date pending.
- FM 5-71-2, *Armored Task-Force Engineer Combat Operations*, June 1996.
- Supported unit's tactical SOP.

All personnel in the ETOC should be trained to conduct basic terrain analysis effectively. This means they must have access and be trained to fully leverage any terrain-analysis product or system available. Also, every member of the ETOC should be trained to operate the available terrain-analysis software.

Synchronizing the Mobility/Countermobility/Survivability (M/CM/S) Effort Among Maneuver Companies/Teams. The ATFE and ETOC are responsible for synchronizing M/CM/S effort across the TF. Clearly communicating the tasks that must be completed and their respective sequence can accomplish this synchronization. The first step toward this goal is publishing an effective engineer annex in the TF operations order (OPORD). This annex should include easily understandable execution matrixes for the TF M/CM/S efforts. The engineer cell should also provide accurate and up-to-date overlays to support each of these plans. The ATFE must ensure that M/S tasks for maneuver elements, essential to TF mission completion, are published in the TF OPORD in paragraph 3—Tasks to Maneuver Units. To help support the engineer annex, there are several graphical tools that can improve the planner's ability to communicate the key tasks and their relation to the time available:

- **Gantt Chart** (See Figure 2, page 66)**.** This tool, often referred to as a timeline, can quickly communicate the task, location, and resource requirements for all critical M/S units or resources. This assists the TF in tracking and logistically supporting engineer assets as they are shifted across the battlefield during preparation for defensive operations.
- **Glide Path** (See Figure 3, page 66)**.** This graphical tool displays actual versus estimated production. Countermobility or survivability effort can be tracked on a glide path. It allows the leadership to determine if units are producing at the level estimated and to project the actual end state. The glide path can identify when decision points are reached to shift key assets to achieve the desired amount of countermobility or survivability effort. This product will allow leadership the opportunity to adjust resource allocation or the tactical plan based on the current production level and an extrapolated estimate of final production for M/S resources.
- **Commander's Card** (See Figures 4 and 5, page 67). This graphical tool keeps the TF commander abreast of the progress of the key M/S assets within the TF sector. It serves as a "blueprint" of the planned engineer effort in sector. The TF's current operations cell and the ETOC update the card at a regular interval, designated by the TF commander.

Publishing the Engineer-Company OPORD. An ETOC should be trained to create and publish the engineer-company OPORD, supplemented with supporting terrain-analysis products, a consolidated graphics overlay, and a comprehensive risk-management document. The engineer annex created during the TF orders process can serve as the base for

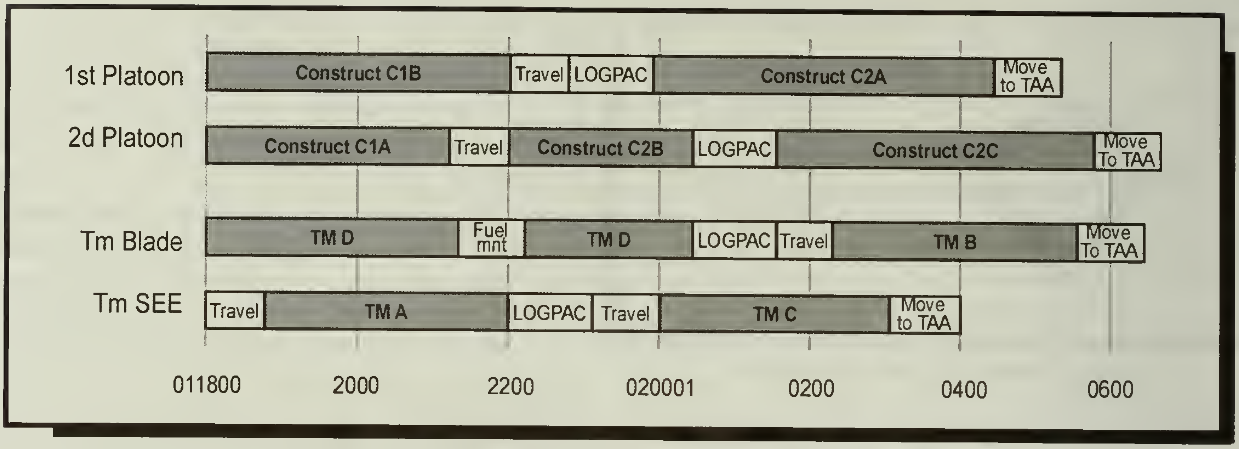


Figure 2. Example Gantt Chart

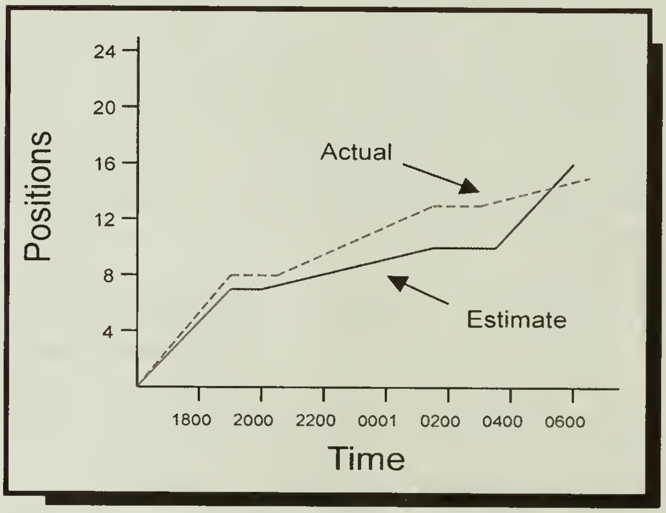


Figure 3. Example Glide Path

this product. By using the engineer annex as the base document and adding the engineer-commander's intent, paragraph IV (Service Support), and paragraph V (Command and Signal)—related to the engineer company—a company-level order is created before publishing the TF OPORD. Executing this parallel planning by the ETOC will ensure that the engineer commander is prepared to issue a full company OPORD before task-organizing subordinates to supported maneuver units.

Usable terrain products must be provided to the subordinate units as part of the company OPORD package. This will allow the engineer leaders in the company to better understand the critical aspects of the terrain they will be operating on and communicate those factors to the maneuver elements that they support. Placing these products directly in the hands of the engineer units will ensure that they are fully leveraged to support completion of the critical M/S tasks.

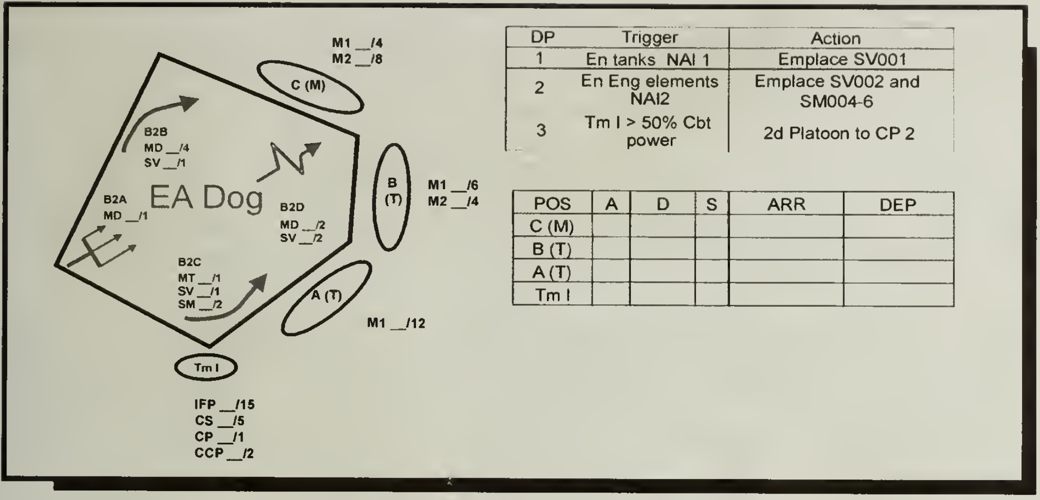
The ETOC has the capability to consolidate all available TF graphics and create a product that is usable by key leaders within the engineer company. This consolidated graphics product should contain information from the following sources:

- TF situation template.
- TF reconnaissance-and-surveillance overlay.
- TF maneuver overlay.
- TF fire-support overlay.
- TF combat-service-support overlay.
- TF M/S overlay.

By using the professional experience of the personnel in the ETOC, and access to the mentioned products, a single graphical product can be created that is tailored to the needs of the engineer leaders. This product can then be issued along with the company OPORD before task organization takes effect. The ETOC can also create a comprehensive risk-management product that the company commander can brief and distribute to the subordinate leaders. By combining the risks and the control measures published by the supported TF and the parent engineer battalion, along with those identified by members of the ETOC, the company-level risk-management product should minimize any loss of combat power or chance of mission failure.

ETOC Individual-Skills Training. Due to the small number of personnel assigned to an ETOC and the requirement to support continuous operations, all personnel assigned to the engineer CP must be trained and ready to execute any task required. To be an effective member of the ETOC team, each member must be trained and certified to execute the following tasks before an NTC rotation:

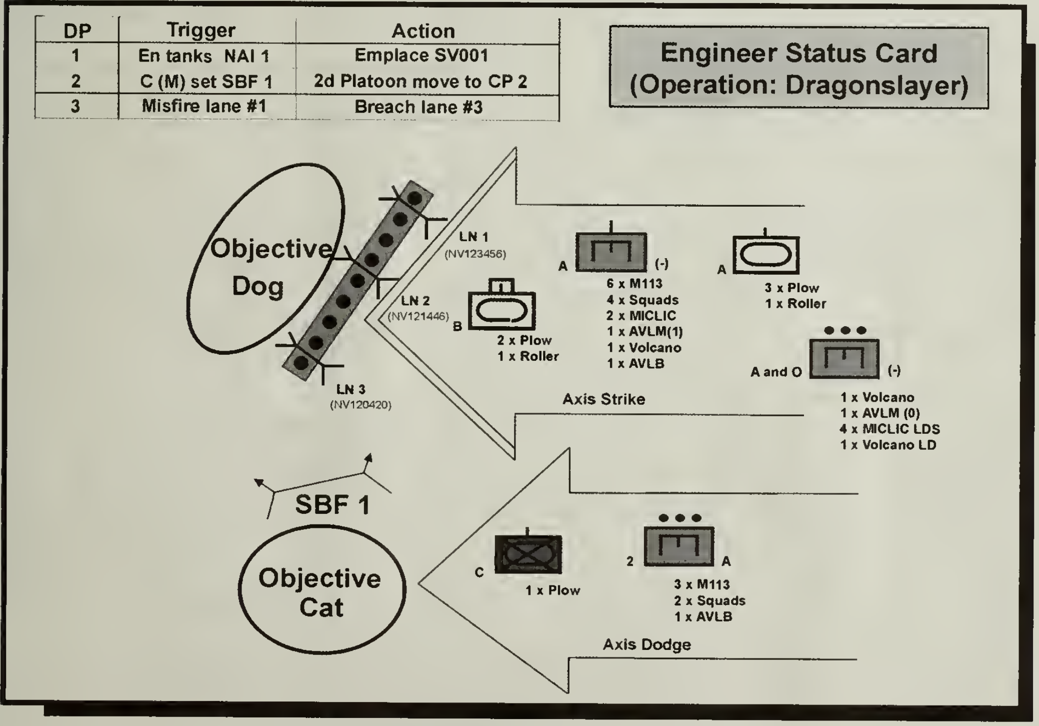
- Operate all assigned vehicles—preventive maintenance checks and services (PMCS).
- Operate all assigned equipment (communications, automation, TerraBase)—PMCS.
- Perform specific tasks in TOC relocation battle drill.
- Serve as radio/telephone operator—understand how to receive and send reports at both company and battalion levels.
- Understand military maneuver graphics and all reports required by higher and lower echelons—battle tracking.
- Conduct shift-change briefing or brief critical M/S events/issues to TF battle captain or TF commander.



DP	Trigger	Action
1	En tanks NAI 1	Emplace SV001
2	En Eng elements NAI2	Emplace SV002 and SM004-6
3	Tm I > 50% Cbt power	2d Platoon to CP 2

POS	A	D	S	ARR	DEP
C (M)					
B (T)					
A (T)					
Tm I					

Figure 4. Example 1, Commander's Card



DP	Trigger	Action
1	En tanks NAI 1	Emplace SV001
2	C (M) set SBF 1	2d Platoon move to CP 2
3	Misfire lane #1	Breach lane #3

Engineer Status Card
(Operation: Dragonslayer)

Figure 5. Example 2, Commander's Card

Conclusion

Adhering to these recommendations and executing the critical tasks do not guarantee success at the NTC. These are recommendations that will greatly increase the potential for successful engineer operations in support of armor, mechanized infantry, or light infantry TFs. True success at NTC is achieved by continuously improving through each mission and then taking lessons learned back to the home station and creating a comprehensive training program to prepare for real-world contingency operations.

Lieutenant Colonel Magness is the engineer battalion S3 trainer on the Sidewinder Team at the National Training Center at Fort Irwin, California. Previous assignments include brigade and battalion S3, 4th Infantry Division, Fort Hood, Texas; company commander, 16th Engineer Battalion, 1st Armored Division, Germany; and platoon leader and battalion staff officer, 17th Engineer Battalion, 2d Armored Division. LTC Magness holds a master's from the University of Texas and is a graduate of the United States Military Academy and the Command and General Staff College .

Captain Ray is a task force engineer observer/controller on the Sidewinder Team at the National Training Center at Fort Irwin, California. Previous assignments include company commander, 84th Engineer Battalion, Fort Richardson, Alaska; platoon leader and battalion staff officer, 91st Engineer Battalion, 1st Cavalry Division; and platoon leader, 2d Engineer Battalion, 2d Infantry Division. CPT Ray is a graduate of the Engineer Officer Basic and Advanced Courses and the Colorado School of Mines.

ENGINEER UPDATE

Commercial numbers are (573) 596-0131, ext. xxxxx, and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Note of Appreciation. Thank you to the many leaders who have participated in the electronic virtual-task and site-selection boards and surveys in recent weeks! These are critical components of training development and we do need your input.

Active Duty Service Obligations (ADSO) Change to Partially Funded Degree Programs. A change to Army Regulation 350-100, *Officer Active Duty Service Obligations*, indicates that officers participating in a partially funded program incur a three-for-one ADSO for time spent in civilian education with a minimum ADSO of 2 years.

POC is CW4 Frederick Kerber, 34088; DSN -4088; or e-mail *kerberf@wood.army.mil.*

Ranger Coding. The Infantry School initially approved the Engineer School's request to Ranger-code 240 noncommissioned-officer positions in light, airborne, and air-assault units. However, the action is currently on hold until TRADOC develops a support plan that meets the Vice Chief of Staff of the Army's guidance to balance Ranger coding between light and mechanized units.

POC is MSG James Keesee, 35850; DSN -5850; e-mail *keeseej@wood.army.mil.*

Command Sergeant Major (CSM) Fall Conference. The United States Army Engineer School's CSM and the Engineer Personnel Proponency Office are planning to hold the CSM Conference in Carlisle Barracks, Pennsylvania, 24-28 September 2001. Engineer CSMs of all components will be invited.

POC is SGM Wade Kerr, 37232; DSN -7232; e-mail *kerrw@wood.army.mil.*

Military Occupational Specialty (MOS) 12C Fast Track. This MOS is included in the Fast Track and Retention in Excellence Program due to Skill Level 10 being overstrength. Thirty-nine 12C10s have been identified for redistribution. The Personnel Command has notified the soldiers identified as being overstrength and encourages them to voluntarily request reclassification into a shortage MOS. If these soldiers fail to reclassify, an MOS may be identified for them. We encourage those who are eligible to request reclassification into 52E.

POC is SGM Wade Kerr, 37232; DSN -7232; e-mail *kerrw@wood.army.mil.*

Army Engineer Doctrine. Joint Publication (JP) 4-04, *Joint Doctrine for Civil Engineering Support,* can be accessed by going to the draft publications section located on the joint doctrine URL site. The World Wide Web URL address is *(http://www.dtic.mil/doctrine/jel/operations.htm).* You can also find JP 3-34, *Engineer Doctrine for Joint Operations*, at this site.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762, or e-mail *snodgrar@wood.army.mil.*

Access to Manuals. Not all engineer materials have been posted. If you require materials which have not yet been posted, contact this office. For a list of engineer manuals on the General Dennis J. Reimer Library, go to *www.adtdl.army.mil/atdls.htm* and click on "Enter the Library." Select "Field Manuals" on the left drop-down menu and "Engineer" on the right drop-down menu. Click "Submit."

POC is Mr. Reggie Snodgrass, 37762; DSN -7762, or e-mail *snodgrar@wood.army.mil.*

Combined Arms Obstacle Breaching Newsletter. The Center for Army Lessons Learned, in cooperation with the U.S. Army Engineer School, is publishing a new newsletter featuring tactics, techniques, and procedures designed to assist in training combined-arms teams for combined-arms obstacle breaching. This publication is a direct result of experiences in the trends reversal process and should provide commanders and staff in the field with a valuable training tool. The publication is due out in July 2001.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762, or e-mail *snodgrar@wood.army.mil.*

Engineer Lessons Learned. We have updated the Doctrine Development Division Lessons Learned Web site. Several units have now sent electronic copies of their respective standing operating procedures (SOPs,) which can be found on the Engineer School Web site. Please continue to forward any engineer lessons learned from exercises and operations. Others may benefit from your experiences.

POC is Mr. Reggie Snodgrass, 37762; DSN -7762, or e-mail *snodgrar@wood.army.mil.*

Webster University Master's Program. Webster University now offers a Master of Arts (MA) in Public Administration. It will allow nontechnical degree holders to undertake postgraduate studies during the Engineer Captain's Career

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Course (ECCC). Participants will take 12 semester hours during ECCC (Phase One) and three semester hours during CAS3 (ECCC Phase Two). They will complete the program over 5 weeks at Fort Leonard Wood with six semester hours of coursework.

POC MAJ Steve Cross, 34128, DSN -4128, or e-mail *crosss@wood.army.mil.*

Countermine POC for Questions. We are ready to tackle any countermine or mine-awareness questions you may have and will get you an answer as quickly as possible. Please call our office or send questions via our Web site.

POC is Mr. Mike White, 36199, DSN -6199, or e-mail *whitemi@wood.army.mil.*

Humanitarian Demining Operations (HDO) Training. Our basic HDO course continues to receive positive feedback from teams in the field (mostly special-forces types). Therefore, we are constantly updating our HDO course. We also encourage comments and information from the field on humanitarian demining.

POC is SGM Kevin Fee, 36199, DSN -6199, or e-mail *feek@wood.army.mil.*

Directorate of Environmental Integration (DEI)

Training Circular (TC) 3-34.489, *The Soldier and the Environment.* This publication was released in April 01 and can be accessed at the Directorate of Environmental Integration's site through the Fort Leonard Wood home page. TC 3-34.489 contains information on personal and professional responsibilities for protecting the environment that soldiers can use to make responsible decisions about the environment. It is the companion to FM 3-100.4, *Environmental Considerations in Military Operations* (Jun 00).

POC is Dr. Rebecca Johnson; 34119, DSN, -4119, or e-mail *johnsonr@wood.army.mil.*

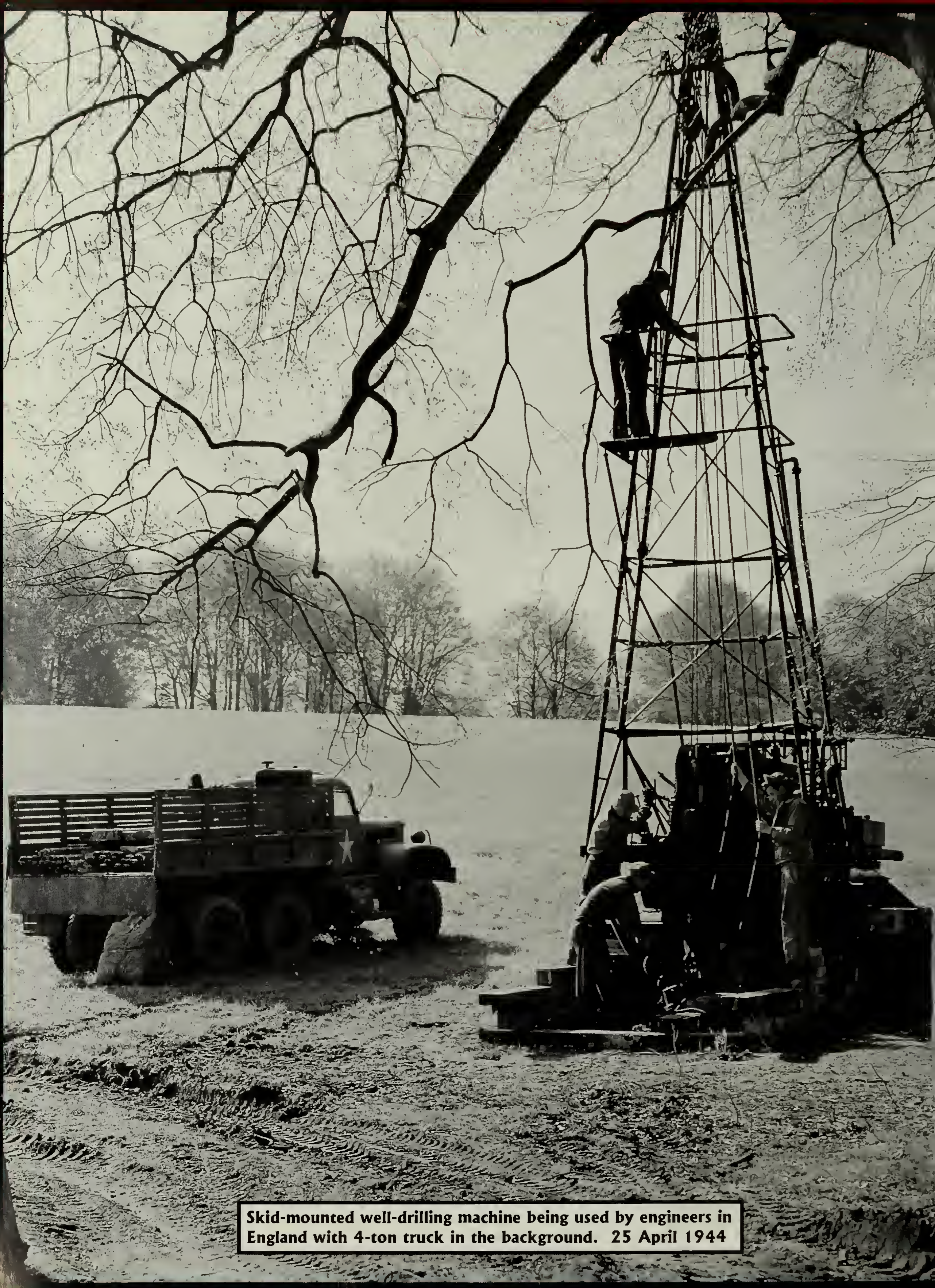
News and Notes

International Society for Terrain-Vehicle Systems (ISTVS) Conference 2002 Vehicle and Terrain Mechanics in the 21st Century Virtual World—Call For Papers. The 14th International Conference of the ISTVS will be held at the Vicksburg Convention Center in Vicksburg, Mississippi, U.S.A., near the U.S. Army Engineer Research and Development Center, from 21 through 25 October 2002. This conference will provide a forum to promote advancement on all aspects of design, development, research, and operations of vehicles and machinery for agriculture, earthmoving, construction, forestry transportation, and military fields. Some specific topics will include terrain and vehicle modeling; terrain, vehicle, and operator interaction simulation and physical evaluation; simulation-based vehicle design and evaluation; and autonomous vehicles, robotics, and intelligent mobility support systems. English will be the official language for this conference; simultaneous translation will NOT be provided. Final versions of the papers shall be in English, in DIN A4 format, and ready to be printed and shall not exceed 10 pages, including tables and figures. The abstracts shall be in English, should not exceed one page, and shall meet the following essential requirements:

- The content shall be of original nature and not published elsewhere.
- Reports about ongoing development and research programs shall show clearly the progress made since earlier publications.
- Contributions on economic and/or strategic considerations shall be related to the conference topics.
- The primary author shall submit his/her complete address and a brief curriculum vitae together with the abstract.

Submit the abstracts as an attached document, using a common word-processing program, to *sshoop@crrel.usace.army.mil.* Include a complete mailing address and short biography of the presenting author. The format for the abstracts is as follows: title case, 16 point bold; author names, 12 point, underline the presenting author; e-mail for presenting author, 12 point; suggested conference topic area, 12 point; text Times New Roman, 12 point, single spaced with 6 point after each paragraph; timetable for preparation of papers; and 1-inch margins on all sides on A4 or 8.5- x 11-inch paper. The timetable is 15 September 2001, deadline for the abstract; 15 November 2001, notification of authors about acceptance of papers; and 1 May 2002, deadline for ready-to-be-printed papers. For more information, go to *www.crrel.usace.army.mil/web-lab/pamb/ISTVS.*

POC is Dr. Sally Shoop, (603) 646-4321 or e-mail *sshoop@crrel.usace.army.mil.*



Skid-mounted well-drilling machine being used by engineers in England with 4-ton truck in the background. 25 April 1944

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